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FAO'S STATISTICAL SERVICES

When David Lubin, the founder of the former International Institute of Agriculture, reviewed the world statistical service available to governments at the beginning of this century, he saw a great gap which was as important to merchants and traders as to farmers. In all countries with an export surplus of agricultural produce the price the farmer received for his crop was controlled by the world price. Yet at that time there were no reliable statistics of world production and trade and, although the highly-developed countries had sound national statistical services, many countries, among them some of the major producers of agricultural commodities, had only the most rudimentary means of collecting crop, price, and other statistics. The statistical work he began in 1904 has led to enormous improvement of world statistics, and FAO's work today in agricultural, forestry and fisheries statistics owes a great deal to this half-century of experience.

As FAO develops and as the statistical services of Member Governments improve, new demands are made and met by the Organization and every year the Monthly Bulletin, the Commodity Reports and the Yearbooks of Agriculture, Forestry and Fisheries further establish themselves as indispensable works of reference.

The annual YEARBOOKS OF FOOD AND AGRICULTURAL STATISTICS, of which the 1952 edition in two volumes has just been published, is a standard reference work for producers, exporters and importers of all kinds of agricultural products. This new edition includes details on land use, irrigation, population, food supply and prices, as well as sections on means of production which includes statistics on commercial fertilizers, farm machinery and pesticides.

The demand for the YEARBOOK OF FOREST PRODUCTS STATISTICS (1953 edition due soon) increases every year. (The 1947 edition is out of print in Rome, but is still available from stocks held by sales agents). The last, 1952, edition covers roundwood (fellings of softwood and hardwood), sawlogs and veneer logs, pulpwood, pitprops, utilization of homegrown and imported roundwood, processed wood and woodpulp and pulp products. It is a practical reference work for producers and traders. Periodical forestry commodity reports are published in FAO's quarterly UNASYLVA.

Both the above yearbooks have their predecessors in the lists of the former International Institute of Agriculture; but FAO is a pioneer in the field of fisheries statistics and the bi-ennial YEARBOOK OF FISHERIES STATISTICS for this reason has probably shown much more rapid development and improvement than the other two. The latest edition (YEARBOOK OF FISHERIES STATISTICS, 1950-51) still modestly looks forward to further improvements in future editions, but it now is the only world-wide source of reliable statistical information which makes international comparison of figures possible.

The YEARBOOK OF FOOD AND AGRICULTURAL STATISTICS can be kept up-to-date by subscribing to the MONTHLY BULLETIN OF AGRICULTURAL ECONOMICS AND STATISTICS. This Bulletin, now in its second volume, has developed considerably in the scope of the statistics offered and by the publications not only of regular Commodity Notes, but also of articles on subjects of general interest to agricultural and fisheries economists. (Fisheries statistics are published in this bulletin and separates are sent to subscribers to the FAO FISHERIES BULLETIN).

Many of the articles deal with aspects of the FAO Program. The results of the 1950 World Agricultural Census are published in the bulletin as they become available and an article is devoted to the whole subject of this project. Articles on random sampling, international index numbers of agricultural production, the emergency food reserve proposals, and regional meetings, targets and agricultural development, all fall into this group of subjects.

Articles of regional interest cover the Near and Far East, Western Europe and New Zealand, and general articles on agricultural development deal with public financing, training in economic appraisal, and the problems of planning agricultural projects.

Of particular interest are basic worldwide studies of most agricultural commodities which appear in the Commodity Bulletin Series. This series is supplemented by shorter and more current Commodity Reports, and by a new series of analytical studies of commodity policies. (These deal with such subjects as the long term contract, the economics of the International Wheat Agreement, national price-control policies, and so on.) The Commodity Series and the Commodity Reports cover most fibers (including silk), fats and oils, grains (including, of course, rice), livestock and meat, dairy products, poultry and eggs, tobacco, citrus and dried fruits, sugar, cocoa and fertilizers.

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CONTENTS

THE AMAZON VALLEY 99

by K. McGrath, R. Gachot and N.M. Gallant, FAO Forestry Mission .....

WATERSHED MANAGEMENT 105

by Verne L. Harper, U.S. Forest Service

COMMODITY REPORTS

Wood pulp 115

Sawn softwood. 124

WORK OF FAO

Forestry Education in Chile 133

International Poplar Meetings 134

Mediterranean Pasture and Fodder Development 135

Technical Assistance Notes 135

EQUIPMENT NEWS 137

NEWS OF THE WORLD 139

SELECTED REVIEWS 143

Cover Photograph: *Examples of* Populus euramericana f. serotina *in the park of the* 12th *century castle of Count Mirbach-Harff at Harff a.d. Erft, Germany. This remarkable collection of poplars, which was recently visited during the* 5th *International Poplar Congress, is likely to be destroyed in the near future by the extension of open-cast mining operations.*

FAO AND RESEARCH

THE FAO Secretariat does not itself initiate or undertake research, but from experience it can suggest and encourage surweys along certain lines which appear of value from the international standpoint. Major research institutes co-operate with FAO in organizing and conducting inquiries, in some cases through the International Union of Forest Research Organizations which is holding its eleventh congress at Rome this month. Another example of co-operation is afforded by the Advisory Board on Pulping Tests, created early in 1953, the members of which belong to prominent research establishments. The members of the technical panels on wood chemistry and on wood technology also render a valuable service by recording the results of research and advising on their application.

At headquarters a summary of forest research and a directory of research organizations have been prepared and will be published later this year. This is a compilation of the work at 177 leading institutions which will serve as a basis for co-ordinating and integrating current forest studies, the elimination of duplication and stimulation of research to fill gaps in present programs on problems of international importance.

Under the Technical Assistance program, general advice and guidance on research has been given in several countries. Specialized advice has also been given, for instance, in regard to wood technology in India and Yugoslavia; again on wood technology and the creation of a research institute in Iran; on the development of forest and forest products research institutes in Austria; and on utilization and housing surveys in Burma. The broad project for a Latin-American Forest Research and Training Institute is making progress, and a scheme is being considered for a regional forest research center in the Near East.

FIGURE 1. *Raft of Aguano (Mahogany) logs being towed into Manaus harbour, and, below,* FIGURE 2. *Itaúba sleepers at Guaporé, which are of an unsatisfactory type — heart-centered pieces cut from immature pole trees.*

The Amazon Valley

Some impressions recorded by the FAO Forestry Mission

by K. McGrath, R. Gachot and N. M. Gallant

The Amazon is an area which has suffered greatly from ill-informed journalism and the creation of the "green hell" legend. It has been equally ill-described as a potential "bread basket of the world." It is, in truth, an area of poor soils and, by tropical standards, of poor quality forest. Over perhaps 99 percent of the area there is little prospect of any traditional type of land colonization based solely on the production of agricultural surpluses.

On the favorable side, however, the magnificent system of waterways, the general ease of topography, and the often open nature of the jungle presents less difficulty to timber extraction than probably any other extensive tropical forest in the world. There is no technical reason why the forests should not be exploited to the limit of available markets. Modern methods of extraction and industrialization could in effect so reduce the selling prices of Amazon timber and other kinds of forest produce that a very much greater outlet than even the quite considerable market that is available today, could undoubtedly be created.

The forests are indeed of enormous extent and, despite the low yield per unit of area, the amount of utilizable timber aggregated over the vast area is of staggering proportions. Given an unlimited market, an enormous timber industry could indeed be visualized. But at the moment, the only reliable market is the domestic Brazilian market. The general supply position to this particular market is now such that it is a matter of urgency for measures to be taken in the Amazon valley to ensure a supply of the timber which will be required for the future development of Brazil. What these internal market requirements will be in the fairly immediate future is unknown. It is beyond doubt, however, that the development of the country can absorb, and at reasonable prices will definitely take, all that an Amazon industry expanded at a practicable rate can produce.

It is certain that overseas markets could also be found to take regular deliveries of standard grades of well-produced and conditioned sawn wood. The Amazon carries a wide variety of woods from the heaviest and most durable to white light substitutes for softwoods. Mahogany and cedar are known to all the world's markets and several other species are already well-known and established in European markets. But the extent to which such markets could be developed would depend largely on the costs of the produce, and even were the demand to be created, it is nevertheless unlikely that international trade could in the foreseeable future occupy other than second place to the domestic Brazilian market itself.

The Forest and its Environment

Within the borders of Brazil, the Amazon forests cover the States of Amazonas and Pará, the territories of Acre, Guaporé, Rio Branco and Amapá, the northern part of Mato Grosso, and a narrow strip of Maranhão. This vast forest area, extending over roughly 40 percent of the whole of Brazil, is still little known. Much progress has been made with studies in the field of systematic botany and many species have been described and identified, but the inventory is still far from accurate.

Likewise, geo-botanical information is too slight for a clear definition of subdivisions. On the basis of the extent of existing or available water, as elaborated later in this article, forest formations of four types can be distinguished:

1. coastal mangrove with characteristic flora;
2. *Varzea* formations;
3. *Igapo* formations;
4. *Terra firma* formations varying with climatic conditions (particularly rainfall): dense forest, dry forest and savanna woodland.

Generally speaking, because of low soil fertility, the dense forest, which covers some 95 percent of the Amazon valley, has a tree flora of which the average height is less than, for example, the African average. Vegetation comparable to the latter is only to be found in stands on soil of volcanic origin.

In the present state of knowledge, it is clearly not possible to describe the forest stand composition; all the information that is available relates to a few species of special commercial value.[1] It is not difficult to appreciate that, because of the vastness of the area, the assembling of all the data necessary for a true appraisal of the forest resources would be a herculean task. The only practicable approach at the moment

[1] The following timber species are fairly well known to foreign trade: Aguano (*Swietenia macrophylla*), Andiroba (*Carapa guianensis*), Assacú (*Eura crepilans*), Cedro (*Cedrela odorata*), Cupiuba (*Goupia glabra*), Freijó (*Cordia coeloiana*), Itauba (*Mezilaurus itauba*), Jacareuba (*Calophyllum brasiliense*), Louro-inhamui (*Nectandra claiophora*), Louro-vermelho (*Ocotea rubra*), Macacauba (*Platymiscium ulei*), Mandioqueira (*Qualia* spp.), Marupá (*Simaruba amara*), Massaranduba (*Mimusops-Manilkara* spp.), Quaruba (*Vochysia* spp.), Sapupira (*Diplotropis martiusii*), Ucuúba (*Virola surinamensis*).

The following species would probably be of interest if fair and steady supplies could be made available: Acapu (*Voucapoua americana*), Anani (*Sympnomia globulifera*), Araracanga (*Aspidosperma desmanthum*), Cumarú (*Coumarouna odorata*), Jacarandá do Pará (*Dalbergia spruceaena*), Jutaí (*Hymenaea coubaril*), Muiracatiara (*Astronium gravcolens*), Muirapiranga (*Brosmium paraense*), Pau Roxo (*Pellegyne paniculata*), Pau d'Arco (*Tabebuia serratifolia*), Tatajuba (*Bagassa guianensis*).

would be to undertake inventories of limited regions selected for economic reasons.

The most important characteristics of the physical composition of the stand are the sparsity of even potentially utilizable lumber trees and the general openness of the stand and absence of vine and undergrowth. This openness plus the ease of topography add up to low access cost and to a large extent compensate the low yield per unit of area served by the access.

Geology and Topography

The Amazon plain may be regarded as two gently sloping surfaces abutting along a somewhat east-west junction corresponding to the course of the main Amazon and Solimoes rivers, and stretching out on either side to attain eventually a proximity to the elevations of the chain of small peaks and plateaus which bind it to the north and, to a much less continuous extent, to the south, well into the center of Brazil. On the west, the plain continues into Bolivia and Peru to the foothills of the Andes.

About 42 percent of the total area, or a million and a half square kilometers, has an elevation between zero and 100 meters and a further million square kilometers (nearly 29 percent) lies at less than 200 meters. The general flatness of the area is in fact its most important characteristic. The general geological picture is of a parent plain of volcanics overlain by a vast spatula of tertiary sandstones, fanning out to cover a huge area west of Manaus and stretching into Peru and Colombia, and being narrowed in between Manaus and the mouth of the river.

Later processes have modified the picture by the action of surface run-off water carving out a pattern of widely separated broad flat valley depressions through which the streams wander slowly changing course and in their annual floodings building a quaternary deposit over the valley flats. An enormous amount of silt is torn off the Andes and the banks of most of the rivers, particularly in their upper courses, and is deposited as the river currents slow down as they reach the east. This has been responsible for the formation of two levels over the previously eroded tertiary deposits — an old quaternary layer[1] above the present levels of river floods, and a recent level being built up by the annual floods.

As the rivers, coming down from what is to the largest extent archaic gneisses and granites, pass over the almost indiscernible junction of the volcanic and the softer sandstones, they spill over in rapids or small waterfalls which are known collectively as *cachoeiras*. The main Amazon-Solimoes axis is somewhat closer to the northern watershed — and to the junction of the volcanics with the sandstones — than to the southern, and since the watersheds to north and south are of almost equal elevation, the waters travel in a much more leisurely fashion to the main Amazon river from the south than from the north.

As a result, shipping may continue from the Amazon up any of the southern tributaries for a very considerable distance before encountering the shallows of rapids, and timber from a big belt of country on this south side may be rafted without difficulty. Even above the rapids on the south side, which means in effect practically all the mahogany belt, floating of timber presents nothing like the difficulties that the very considerable falls and rapids on the north side constitute. Here the crossing of the junction of the two geological series produces real waterfalls instead of mere rapids.

Hydrology

The principal feature of the stream flow of the Amazon and its larger tributaries is that each year the rivers rise to an annual floodcrest and then recede to a period of minimum flow. On an average the cycle starts at dead low in September-October, the rivers begin to rise in November and continue to rise to a top level in May, after which they start to recede again. The recent quaternary level, already referred to, is flooded during this cycle generally from early February until towards the end of July.

The lower courses of the major tributaries of the Amazon itself form a system of lakes and parañás, interlocking and interlacing watercourses spread over a vast width with the mother river winding between them. In addition to direct discharge to the main river, the tributary streams frequently enter a network of lakes or deltas which may themselves be interlaced with those of adjoining tributaries before their waters finally reach the river proper. In the lower rivers the rise of the floods may inundate all the intervening land and give rise to enormous areas of *Varzea* or flood plain receiving annual deposition of silt. Further up the rivers the *Varzea* decreases, but there may still be a wide belt of low flat quaternary land bordering the rivers through which wind a maze of depressions and dry water courses which will be flushed by backwaters of the main stream in the flood period.

These courses may in the wet season provide water access to within the forest, but in the dry period they constitute a real problem in land transport to the main stream. Even when they carry water, they are still a very indirect means of progress in a given direction because the backwaters which flush them enter the system by so many devious routes that there is no reliability in the flow of the currents along any one route. Progress is now with the current, now against it, and the sweep changes at each junction and each entry to a swamp. The utilization of this watercourse system thus may enormously increase the distance to be maneuvred to a given point, and requires intimate local knowledge to ensure that the desired vicinity is reached.

Logging Operations

Enough has been said to show that rivers are the highways of Amazonia and the existing sawmills have been located to draw their supplies in rafts from upstream. But arising from the fact that no power other than manpower exists for the extraction of logs from the stump to the watercourse, log supply is disorganized, uncertain and costly.

[1] The old quaternary is at its greatest development in the river estuary or island region of Belem, but the area still flooded every year along the main river valley is of enormous extent. The flooded areas are termed *Varzea* if they are receiving annual depositions of silt or *Igapo* where they are merely covered by clear water without material in suspension; the two types pose different problems of access, have different forests and different land utilization possibilities. In local parlance all firm lands above flood level are called *terra firma*, irrespective of the geological series to which they belong.

The Amazon Valley covers nearly 42 percent of the land area of Brazil and extends into Bolivia, Colombia and Peru. Within Brazil itself, the valley comprises the States of Amazonas and Parà, and the Federal Territories of Guaporé, Acre, Rio Branco and Amapá. Areas shaded in the above map indicate land over 600 m. elevation.

In the first place, logging operations are necessarily restricted to the frontages bordering the watercourses, and consequently the species now established on the market are not necessarily those of the greatest utility but rather such as are found close to the rivers. Moreover, the quality of the logs which reach a mill is determined not by their milling utility but by the ease or difficulty which they present to muscle-powered extraction.

Another and most important result of the fact that kilometers by water are of less consequence than meters by land is that mills, particularly in the island region of Belem, lose all geographic relationship to their areas of supply; with logging operations scattered over vast distances along the rivers, difficulties of administration and organization are accentuated. The picture is thus not really one of forest exploitation — for the real forest of the Amazon still lies on the vast waterless *planalto* and remains virtually untouched.

The general principle by which manpower is used to extract timber is much the same throughout the Amazon and variations in practice are mere modifications necessitated by peculiarities of topography or forest type which may differ with locality. Thus in the typical picture, the trees are felled by axes, worked into lengths of 4 meters and rolled to the water where they are tied into rafts with wire rope or vines and towed by launch to the mill.

To permit the logs to be rolled, a track is cut six meters wide and as direct as possible from stump to water edge. It is provided with three parallel lines of continuous skids of round timber 6-9 inches (15-23 cm.) thick which are laid on the ground for the full length of the track. The logs are maneuvered on to the skids and with or without the use of levers, are rolled on the skids to the water. In general, the distance over which the logs are rolled is not great but in special circumstances it may stretch to 2,000 yards (1,800 m.) or more.

However, since the general picture of the Amazon area is of a river pattern of roughly parallel main tributaries 100-200 miles (160-320 km.) apart, with largely waterless country between, and with the best forests on the higher country of the interior, it is apparent that the methods now used are not only primitive and inefficient but are incapable of tapping the real timber wealth of the Amazon.

Soils

The existence of a so-called luxuriant rain forest vegetation is the origin of considerable and misleading literature on Amazon agricultural potential. It has not always been recognized that the tropical rain forest is primarily the creation of the climate, that it lives mainly on its own wastes and, once established, is largely self-sustaining. Its major requirement of the soil is continuous moisture, and it makes very little chemical demands and almost none on the upper horizons which agriculture would utilize.

The most significant evidence as to the possible value of the soil is the laterization which in a general way attacks all the soils of the *terra firma* itself. There is considerable doubt as to whether the exact chemical process is one of laterization or of tropical podsolization, but for practical purposes the end effect is the same — with leaching of the soluble bases, the soil is finally composed of variable proportions of hydroxides of iron and aluminum, and in their most advanced condition they are able to offer no element assimilable by plants.

That the Amazonian soils have not proceeded to a final deteriorated condition is due to the forest cover

which protects the soil from the conditions necessary for advanced laterization — absence of humus, open exposure to precipitation, marked alternation of wet and dry soil moisture conditions, high soil temperatures. But evidence of this type of soil alteration is indeed available over the whole region — the formation of spotted nodules in layers below the surface or the general appearance of layers of concretations or encrustations of hydroxides of iron and aluminum.

The soils of the *Varzea* areas are, however, unique in that they are not attacked by laterization and, being provided annually with depositions from the "white" waters, their fertility is considerable. They offer the only areas naturally suited to sustained agriculture in the Amazon; but control of the water required to permit their utilization to full advantage and the difficulty of mechanized working present real problems in the production of foodstuffs of the type the Amazon requires.

On the *terra firma*, agriculture has been practicable only under shifting cultivation. Generally one to three crops on a single area are all that is possible but rare instances of six crops of *manioc* have been observed. In the Braganca region, traditionally Belem's local supplier, increasing population has shortened the rotation under which lands have to be re-utilized to the point that, through exposure, they are now in a state of advanced laterization.

If properly organized, there is no reason, except economic, why shifting cultivation on long-term rotations should not be practicable, but otherwise the *terra firma* soils could not provide for permanent agriculture, other than to serve as the physical vehicle for applied chemical plant foods, for which purpose their physical condition is quite good. Although possibly more remote in location, the richer volcanic soils offer greater possibilities of continued agriculture on the firm lands, but these are similarly affected by laterization processes, and experience of lixiviation and erosion to the point of loss of all fertility following deforestation of somewhat similar soils of the Rio Paraiba do sul, the Paulista plateau, the Rio Doce, and elsewhere, does not induce optimism.

The general character of the soils is loamy clay of a physical type highly suitable to agriculture and equally to the construction of low cost earth roads for mechanical extraction of timber. Despite the high rainfall it is felt that on these soils mechanical extraction could be practised with no more disruption by weather conditions than is normal to tropical working.

Climate

The Amazon region runs true to the general conditions of the world's equatorial regions as regards temperatures — dry bulb temperatures are only moderately high and there is little variation in the daily or annual range. The warmest weather is generally in the low rainfall period and the coolest in the wet season. Near the coast the average maxima are about 85-87 degrees F. (29°-30° C.) with absolute maxima rarely above 90 degrees (32° C.) and the minima, averaging 72-75 degrees, (22°-23° C.) seldom drop below 70 degrees (21° C.). Further inland the disparity is greater with absolute maxima above 95 degrees (34.5° C.) and minima of 60 degrees (15° C.) and a general range of 15-20 degrees (8°-11° C.) occurring between day and night.

The relative humidity increases gradually from the coast inland and for the whole area averages about 80 percent.

The almost universal pleasant breeze is, however, most important in relation to human comfort in the Amazon and a factor whose effect is incapable of sufficient expression in any statistical attempt to characterize the Amazonian climate. The region is indeed one of light winds and occasional calms, or general trade winds. High winds are practically unknown, and no tropical cyclones invade the area. For nine months of the year the northeast trade wind comes from squarely offshore and blows right up the valley, and the more unpleasant season (July-October) for inland areas is associated with the establishment of the doldrums to the north of the area, in consequence of which the winds do not blow direct inland. Then the decided contrast between the quite pleasant climate of Belem and the sticky unpleasantness of Manaus, despite its cooler nights, is understandable only in terms of breeze.

The region is one of abundant and widely distributed rainfall, amounting to perhaps 80 inches (2,000 mm.) over the area as a whole. There is a belt of below-average precipitation running north along the Xingú river to the Amazon and then bending west of north along Rio Branco into British Guiana; here the annual rainfall may drop to 60 inches (1,500 mm.). Wetter belts cover a crescent on the east, including all the island of Marajó and then swinging away to the coast, and in the west extending from the rivers Negro and Tapajós to the borders of Colombia, Peru and Bolivia. Within the latter belt are two centers of very high rainfall which, together with a lesser area on the coastal strip, constitute the three zones which experience rainfalls of over 100 inches (2,500 mm.).

The climatic conditions are completely favorable to luxuriant vegetation, and the reason that the vegetation is not, by rain forest standards, in fact luxuriant is due to the poverty of the soil. For the same reason, and not because of the climate, the area is not densely populated. In fact the bar to the satisfactory colonization of the Amazon has been not climate but nutrition and hygiene.

There have been several spectacular outbreaks of malaria in the Amazon (notably on the infamous "life per sleeper" Guaporé railway), but malaria is neither so great a hazard as elsewhere in the tropics nor is it generally as difficult to control. Of 30 species of anopheline mosquitoes in the Amazon, only two carry malaria, and one of these, breeding only in saline waters, is not only restricted to a small area on the coast but has been completely controlled. It can be stated that malaria is no longer a problem except where, by reason of the sparsity of population, effective control is difficult to implement.

Other well-known tropical diseases are common, in particular hookworm, amoebic dysentery, bacillary dysentery and intestinal worms. Filaria, and its final stages, elephantiasis, have previously been serious but their culex vector has been practically eliminated in the process of malarial control. These diseases cause much suffering and misery but they are not themselves the direct reason for the high death rate; malnutrition reduces resistance to such a point that death from other causes is inevitable.

There is no evidence to suggest that further coloniza-

tion, if it could be made self-supporting, would be confronted by any serious problems. Surprisingly, the Amazon valley can be regarded as one of the potentially most healthy tropical areas of the world, despite a present average expectation of life of only 39 years.

Present populations

At present the Caboclé, who is of mixed European and Indian blood and constitutes 49 percent of the population of the Amazon, is the foundation of the economy. He is essentially a man of the river and forest. He is nomadic and not disposed to agricultural practice, and no attraction as, for example, was offered him in the Ford Company plantations would either anchor him or buy his continued performance of plantation work. Education, far from securing him to the land, at once tempts him to the city.

However, timber work in the forest, on the river or in the sawmill appeals to him. In the mill, routine work with logs, lumber and machinery attracts him, while in the forest the diversity of the activities in his native element makes work akin to the carefree picnic existence of the Caboclé's natural inclination.

Then there are also the Indians. No exact estimate of the Indian population has been made but the best guesses place their numbers at around 10,000. They belong to many tribes, some of which are docile but more are hostile.

The official Government attitude to the Indians is extremely sympathetic and laws relating to the interaction of Brazilians and Indians are weighted very heavily in the latter's favor. Despite this, so-called civilization has contrived its own very realistic measures to control any Indian menace.

Though they are a danger to unaccompanied explorers in the jungle, the Indians will not usually attack groups of men. But tribes of exceptional animosity, for instance the Tupi or the Gê Indians, cannot be relied on to subscribe to this generalization. On the Tocantins river, for example, it is almost an annual event for the Tupi to come down from the interior in the dry season when food is scarce and shoot up the Government train which cuts them off from the river and its fishing.

Nevertheless, it is of interest that the whole of the mahogany belt is peopled by Indians and any real extraction industry there would have to take serious precautions to ensure the safety of both personnel and equipment. Otherwise, Indians are of no consequence in the areas at present being worked for timber, and there is a considerable area available for extension of forest exploitation in which there is no Indian problem.

Prospects for Development

So vast is the area and so few the people living in the Amazon valley that there has not been the urgency to draw up a classification of land for sound use — which traditionally is done not to plan development so much as to control extension of land despoiliation after this evil has arisen. However, it is constitutionally provided in Brazil that 3 percent of the national revenue shall be devoted to Amazon development, and to administer this fund a *Commissão de Valorisacão da Amazonia* is in process of establishment. This body will presumably determine the future lines of development and have in its power the possibility of giving a real impetus to welding diverse interests into a co-ordinated scheme of sound land use.

Very considerable studies have indeed already been made in the Amazon on many aspects connected with possible land use but, without the urgency of a pressing problem, they repose in libraries as being little more than of academic interest. Until now, each of these studies has followed the particular inclination of the worker, and has had little reference to the development of an overall picture, with the result that there has been much overlapping and misdirected investigation.

Recognizing the need for an integration of all studies towards a definite objective, the *Instituto Brasileiro de Geographia y Estatistica* has set about the task of assembling what is known of Brazil and in what respect information is lacking. For this purpose, it has constituted a number of internal sections, each charged with responsibility for a defined region of the country, of which the Amazon valley is one. The first task of the Amazon section is to assemble a bibliography of what has been done; secondly to examine, sift and summarize the various treatises; and finally to carry out field studies either to supply missing information or to confirm or deny the findings of previous workers. This work is in progress and the region is being examined area by area to give each part such detailed study as is warranted.

The Amazon section is staffed by competent scientists who can call on the full assistance of economists and statisticians. It has, in addition, the co-operation of the Brazilian Air Force and of the State Governors to assist with field excursions and air surveys. True, it labors under some difficulties which hamper continuity of the investigations, but nevertheless it is engaged in serious work which is of fundamental importance in determining a sound use for the whole area. Although the section functions purely as an advisory organ, it can be expected to play an important part in the decisions of the *Commissão de Valorisacão da Amazonia* when it is fully operative.

As an adjunct to the work of the *Instituto*, a research institute to investigate the evidence or to test conclusions is essential. To a limited extent such an institution exists in the *Instituto do Agricultura do Norte* which is a well-staffed and well-equipped body having the benefit of ample demonstration areas — including inheritance of all the Ford Company achievements at Fordlandia and Belterra, as well as areas in the vicinity of Belem and elsewhere.

The immediate need in the Amazon is the selection of suitable areas and economic assistance for the establishment of an agricultural industry capable of feeding the present inhabitants, so as to obviate dependence on outside sources and eliminate the importance of the trader on whom all food supplies at present depend. Sufficient information already exists to permit this objective being soon achieved and tentative beginnings have already been made in the Guama valley, at Santarem, and at Manacapuru.

But by the Amazon we really mean the *planalto* and only with its wide-scale utilization will any degree of real occupation of the region ensue. As has already been said, the poverty of the soils eliminates serious consideration of their settlement on the traditional

basis of agricultural colonization. But they carry an enormous volume of timber and although the planners have not hitherto seriously considered the possibility of forest industries as providing the cornerstone for colonization, such industries do indeed provide such an opportunity and are in fact the only possibility on the basis of present knowledge. The development of the timber industry and colonization are inseparable complements to each other.

The most pertinent facts about the present timber position in the Amazon are the serious shortage of sawn timber in the remote areas and the excessive prices of timber throughout the valley, prices that are beyond the average local purse. In the remoter areas, a solution undoubtedly lies in the installation of small portable units in centers of exploitation that are as close as possible to the demand. Elsewhere, production costs must somehow be brought down in the interest both of the local and of the export market.

This lowering of production costs can be effected by rationalized extraction, with a more direct linkage between sawmill and forest and with fewer middle men in between; by improved sawmilling facilities, and by a steady supply of labor that is rendered contented and maybe cheaper by making a greater variety of foodstuffs available at prices that labor can afford to pay.

Can the local market be developed materially? Three to four times the present consumption could probably be absorbed with ease, if prices were correct and if the industry were located so as to ensure proper distribution. A good deal devolves on the effectiveness of the *Commissão de Valorisação da Amazonia*. If its objectives are attained, there should be a greater area under cultivation in the Amazon and a greater variety of cheaper foodstuffs, an accelerated rate of increase of the population, and a marked improvement in living standards. A regular supply of forest and sawmill labor should result, a supply that must somehow be safeguarded from enticement by other activities that may appear to become more remunerative.

A new economy required

Having in mind what needs to be done to achieve the development of a timber industry in the Amazon, a sound rate to aim at would appear to be a threefold increase of production over the next ten years. Anything bigger would be to explore the realm of fantasy and to founder any plan on unreality and lack of appreciation of Amazon conditions. Three centuries of a "collection" economy and a trading psychology have produced a set of conditions in the Amazon valley unsympathetic to the founding of any sound industry.

For instance, the Amazon's 3,500,000 square kilometers produce less than half of the foodstuff, other than manioc and corn, consumed by the mere two million inhabitants, and the people are so inadequately fed that malnutrition and undernourishment are major medical problems. Moreover, the habits and philosophies of all the peoples who now populate the Amazon basin tend to be alien to a permanent and substantial economy.

Little contribution to a threefold increase in forest output could come from the present so-called timber industries, for they add up to no more than just another unit of the "collection" economy, operated not by technicians but by traders. The rosewood oil industry is facing extinction unless it can be rationalized and its raw material supplies made cheaper and more readily and reliably available. In the center of one of the largest of the world's forest areas, town authorities are turning to oil, of which there is no national source of supply, to replace firewood which they can no longer obtain in quantities sufficient to avoid a continually rationed and uncertain supply of urban electricity.

It is true of course that existing industries could be assisted in some degree and the first task is in fact to develop them to the maximum of their possible efficiency. But still, this would not greatly increase productivity, for the present forest industries suffer organically from an establishment so basically opposed to modern flow production, the machinery is so inadequate and incorrect in type, and the trader type of management so inefficient that they can make little contribution in volume to anything in the nature of a threefold increase.

An increase in production of the magnitude visualized could stem only from completely new industries and new investment. It would not be sufficient merely to demonstrate sound exploitation techniques. Expanded output requires the tabulation of data on possible forest yields and detailed mapping — desirable indeed for existing exploitation but essential to any organized extraction planning. It requires detailed information on the commercial and industrial possibilities of species other than the few timbers already accepted. And, above all, it requires an influx of new people, provided for locally in food, housing, medical services and amenities such as could alone make them dependable and stable members of industrial enterprises. The exploitation and industrial techniques they would use are indeed not new — merely the standard methods well developed elsewhere, with minor adaptions to Amazonian use. But the methods would have to be demonstrated and operators trained.

In short, to justify confidence in developing the forest resources of the Amazon, it must be shown that the timber is there and accessible in sufficient volume; that it can be got out reliably and economically, and be delivered to centers strategically favorable to the establishment of industries; that colonization on modern lines is practicable; that taxation will be equitable and the method of collection not unduly burdensome; and that the official attitude is sympathetic to and desirous of establishing the conditions which could be attractive to new developments and favorable to investment.

Whatever inducements are necessary to bring about these conditions and attract investment into the Amazon valley need to be given every consideration. The Amazon valley now yields 1 percent of the national revenue of Brazil and receives 3 percent, but it could be made a self-supporting area if soundly developed and sympathetically administered. The establishment of new forest industries could eventually render it solvent and convert the region from a fiscal burden on the south of Brazil into a flourishing internal market for nationally manufactured products.

Watershed Management

Forest and Range Aspects in the United States

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Watershed management problems in the United States can more readily be understood by first getting a picture of the water supply situation.

The eastern part of the country is relatively humid with annual precipitation ranging from 30 to 80 inches[1] and more — fairly well distributed throughout the year. In the western part conditions are quite different. Its interior region gets less than 20 inches[2] of precipitation per year, with most of that falling during the winter months. This general aridity is modified, however, by high mountains which intercept moisture from prevailing air currents moving eastward from the Pacific Ocean and northward from the Gulf of Mexico. These mountains are the "humid islands" that provide the source of most of the perpetually flowing streams. Precipitation on the mountains varies from about 20 inches[2] at the lower-slope elevations to about 80 inches[3] at the high altitudes. Much of it falls as snow.

The North Pacific coastal region, west of the Cascade Range, has abundant precipitation. But the South Pacific coastal region, west of the Sierra Nevada, has a Mediterranean climate. In this area intensive agriculture is possible only by irrigation.

Except for localized summer storms, most of the western part of the country has a long, dry season. Throughout the mid-continent area, the summer discharge of streams is about 25 percent of the average

[1] 760-1,870 mm. [2] 500 mm. [3] 2,000 mm.

Figure 1. *Flood-source areas caused by fire and excessive grazing, Wasatch Mountains, Utah.*
By courtesy of the U.S. Forest Service

flow. In the North Pacific coastal region and throughout the eastern part of the country, the summer discharge of streams is commonly not less than 50 percent of the average flow.

The seventeen western states comprise about 60 percent of the land area of the country, but they have less than 25 percent of the total water supply. The water yield of the West as a whole is less than 4 inches[4] per year; that of the East is about 16 inches[5]. Forest and range land comprises about two-thirds of the total area of the United States. Since forests occupy the regions of heaviest precipitation, it is probable that 70 to 75 percent of the nation's total water yield is from forests and ranges.

About 12 percent of the nation's total water yield is withdrawn for consumptive uses. Of this water, 40 percent is used for irrigation, 40 percent for industrial purposes, 8 percent for municipal water supply, and 2 percent for rural water supply other than irrigation.

Fifty years ago, the consumptive withdrawal amounted to about 500[6] gallons per caput per day. By 1950 it had increased to 1,100[7] per day. Demand is increasing at a rate that may reach 2,000 gallons[8] per caput per day by 1975. A large part of the water withdrawn for industrial and municipal uses does return to the streams, but much of it is loaded with wastes and other impurities. The greater part of the water withdrawn for irrigation is lost through evaporation and transpiration.

The consumptive withdrawals, of course, do not include a much larger volume of water used for generation of hydroelectric power, for inland navigation, for fish and wildlife habitat, and for recreational purposes. Conflicting demands for use of water are major economic and political problems in many localities. These will grow sharper as more of the available supply is withdrawn for consumptive uses.

Improvements and projects of various kinds for the use and control of water represent a present investment of about $50 billion[9]. About one-fourth of this total has been invested by the Federal Government. Plans now in the making contemplate an additional $ 50 billion of Federal expenditure. If these plans materialize, along with other plans of private interests and of local government, a further investment of $75 billion to $100 billion is to be expected in the next fifty years.

Development of Public Concern about Watershed Values

Recognition of the public interest in watershed lands began to take definite form in the United States about sixty years ago. An Act of Congress passed in 1891 directed the President to establish forest reserves out of the forested public domain lands remaining in the western states. While this law made no direct reference to watershed values, the Congressional debates which led up to its passage show that its sponsors included the restraining of floods and the protection of streamflow and water supplies as one of the important purposes to be served. A subsequent law passed in 1897 provided for permanent Federal administration of these lands and specified the " securing of favorable water flows " as one of the purposes they were intended to serve.

Some 138,000,000 acres[10] of public land were set aside as forest reserves during the period 1891-1907 under authority of these two laws. During this interim the reserves came to be known as national forests. Their administration was assigned to the Forest Service, a bureau of the Department of Agriculture. A management policy was developed based on the principle of multiple use in which timber production, watershed protection, grazing, wildlife habitat, and recreational values were all given recognition.

This approach to the watershed-management problem, however, had limited, even though important, application because by 1891 the only large areas of forested public domain land were in the western states. The next important development came in 1911 with the passage of the so-called Weeks Act[11]. This law authorized the Federal Government to purchase forested, cut-over, or denuded lands within the watersheds of navigable streams for the specified purpose of " regulation of the flow of navigable streams or for the production of timber. " Largely under this authorization, some 22,000,000[12] acres of forest watershed lands have thus far been acquired — mostly in the eastern states. All these lands are managed as part of the national forest system.

The Weeks Act also initiated a co-operative Federal-State program for protection of private and other non-Federal forest lands from fire. Protection of water resources is one of the stated objectives of the act. This program was greatly strengthened by the Clarke-McNary Act of 1924 which authorized the Federal Government to supply up to one-half of the funds spent by the States for prevention and suppression of fire on such lands. In order to qualify for this financial assistance, a state fire protection system must meet certain minimum standards prescribed by the Secretary of Agriculture. The state contributions to its financing have usually exceeded those made by the Federal Government to a considerable extent. The co-operative system of fire protection now covers about 400,000,000 acres[13] of non-Federal forest land, but there are about 60,000,000 acres[14] of such land still without organized protection. The unprotected area has, however, been shrinking rapidly in recent years. Coverage may soon be almost complete. The Federally-owned forest lands have been under organized fire protection for a long time.

Forest-insect and tree-disease epidemics destroy timber growth and increase fire hazards. Their control, therefore, is another important aspect of forest protection. In this field, however, progress has lagged – chiefly because the damage is not so readily visible until it has become extensive, and because the control job is more difficult. Losses to forest pests have recently exceeded those due to fire by a substantial amount. A desire for more effective control led to the passage of the Forest Pest Control Act of 1947. This lays down a policy of strong Federal leadership in formulating

[4] 100 mm. [5] 400 mm. [6] 1,900 liters. [7] 4,160 liters. [8] 7,570 liters. [9] $50,000 million. [10] 55,850,000 ha. [11] An Act of Congress often takes the name of the member or members who introduce it. This one was introduced and sponsored by Senator Weeks of Massachusetts. [12] 8,900,000 ha. [13] 162,000,000 ha. [14] 24,300,000 ha.

FIGURE 2. *Contour trenches constructed by the Forest Service on flood-source areas to prevent surface run-off. The upper trench is roughed out by bulldozer, lower trenches being finished by hand. Note the cross-dams in each trench.*

By courtesy of the U.S. Forest Service.

and carrying out control programs. One of the several stated objectives of the new law is to " conserve forest cover on watersheds. "

Other features in the development of the forestry program which contribute to conservation of watershed values include the McSweeney-McNary Forest Research Act of 1928 authorizing, among other things, studies of the best methods for " maintaining favorable conditions of waterflow and the prevention of erosion; " and the Co-operative Forest Management Act of 1950 authorizing Federal financial assistance to states for a program of technical assistance to private landowners. A number of other laws that have some bearing on the protection or improvement of forest and range watersheds could be cited.

Although recognition of the public interest in watershed lands began with the forests, it has gradually been extended to other lands. Some 235,000,000 acres[15] of unappropriated public domain land remained in the West after the national forest withdrawals had been completed. Most of such land was used for livestock grazing by whomsoever wanted to make use of it. The result was a progressive deterioration of the soil and forage cover, often followed by serious erosion and flash floods. The Taylor Grazing Act of 1934 authorized the Secretary of the Interior to establish grazing districts in order to bring about more orderly use of such land under a permit system. The law recognized the direct tie between water and land by authorizing the Secretary to " continue the study of erosion and flood control and to perform such work as may be necessary to protect and rehabilitate such areas. " Unfortunately, the funds that have been made available for this use have not been sufficient to do more than a small amount of rehabilitation work.

The sense of urgency to do something about soil erosion control became manifest in 1933 with the establishment of a Soil Erosion Service in the Department of the Interior. This was a part of the national effort to relieve unemployment. Funds were made available and a considerable amount of work was started. The initial attack was greatly strengthened with the passage of the National Erosion Control Act of 1935 in which Congress declared its policy " to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands, and relieve unemployment. " This law transferred responsibility for erosion control work to the Department of Agriculture and authorized the establishment of a Soil Conservation Service to conduct surveys, carry out preventive measures, and furnish technical and financial assistance to suitable districts set up under state law. All states now have such laws, and the pattern of Soil Conservation Districts is nation-wide and includes about three-fourths of the total land area of the country.

[15] 95,100,000 ha.

Federal appropriations for the work of the Soil Conservation Service have recently been about $ 60 million per year.

Direct financial aid to farm owners and operators to help them carry out soil-conserving practices has been available since 1936. This was authorized by the Soil Conservation and Domestic Allotment Act, which, among other things, sought "diminution of exploitation and wasteful and unscientific use of national soil resources and the protection of rivers and harbors against the results of soil erosion in aid of maintaining the navigability of waters and water courses and in aid of flood control."

While the primary objective of this law was the restoration of farmers' purchasing power, the direct payments made to each individual farmer were measured by whatever previous-year improvements he had made in the management of soil and water. These payments are a partial return to him for the costs of terracing sloping fields, for contour cultivation and strip cropping, for establishment of sod waterways to dispose of excess water, for revegetation of severely eroded land, for pasture reseeding and fertilization, for planting trees, and for various other improvements of similar character. Appropriations to carry out this program have been running at about $ 250 million per year.

The first direct tie-in of these various land-use programs with the program of engineering works for flood control came in the Flood Control Act of 1936. Declaring that "investigations and improvements of rivers and other waterways, including watersheds thereof, for flood control purposes are in the interest of the general welfare," Congress directed that the control of floods by engineering works should be expanded to include "investigations of watersheds and measures for run-off and waterflow retardation and soil erosion prevention." Responsibility for these watershed investigations was assigned to the Department of Agriculture. Two years later, the Secretary of Agriculture was authorized to install "works of improvement for measures of run-off and waterflow retardation and soil erosion prevention" on watersheds for which the Department of the Army had been authorized to install flood control engineering works or improvements[16].

Under the authority of these laws, the Department of Agriculture has carried on surveys (completed or in progress) which cover about one-third of the country. The program, as the Department has developed it, calls generally for a speed-up and intensification of land-and-water-conserving measures that have been developed over the years. In addition it includes construction of small water-retarding and silt-detention structures on headwater tributaries, streambank stabilization, and channel-clearance work. An action program, in accordance with survey plans, is in progress on eleven small watersheds located in various parts of the country. Survey reports covering quite a number of additional watersheds are being considered by the Congress.

[16] The Department of the Army is the agency with principal responsibility for construction of engineering works for flood control purposes.

FIGURE 3. *Contour trenches fully vegetated, in the same location as in* FIGURE 2. *Note the white stone in the foreground in both photographs.*

By courtesy of the U.S. Forest Service

Status of the Art of Watershed Management

While the evidence of public concern about watershed conditions in the United States is ample enough, the practice of the art of watershed management is still in its infancy. This is due in large part to scarcity of technical knowledge of the ways in which vegetative cover and soil-mantle conditions affect the behavior of water prior to the time that it enters streams, lakes and aquifers. There are still wide differences of opinion as to the practicability of attaining substantial modifications of run-off and streamflow, especially on large drainage basins, by means of watershed management. There are people who contend that any kind of vegetative cover is about as good as another for purposes of retarding run-off. This point of view is most common in the eastern part of the country. In the West, where water yield is of major concern, there are others who urge that vegetation on the mountains be reduced to a minimum in order to increase run-off for impoundment in reservoirs. There are still others who look upon any insistence upon watershed protection as undue interference with their private right to use land entirely for profit-making purposes, such as grazing or timber production. These issues are not easily resolved.

The soundest possible course is to undertake scientific investigations and to be guided by the results in developing policies and programs. Research and experimentation and large-scale tests on pilot watersheds began in 1909 when the Forest Service and the Weather Bureau established co-operatively small experimental watersheds at Wagon Wheel Gap in the Rocky Mountains of Colorado. Since that time, the Forest Service has established two specialized watershed research units – the San Dimas Hydrologic Laboratory in the chaparral region of southern California and the Coweeta Hydrologic Laboratory in the deciduous forest area of western North Carolina[17]. Each of these experimental-watershed areas was first subjected to intensive calibration, including topographic and vegetation surveys, measurements of the amount and character of the precipitation, volume, and distribution of streamflow and its sediment loads, fluctuations in groundwater levels, and various other related factors. After these characteristics were determined, it was then possible to make changes in the forest, brush, and herbaceous cover and to measure the hydrologic effects of such changes. Similar experimentation on a less intensive scale or on special aspects of the watershed management problem is underway on about a dozen other experimental forests and ranges. The Soil Conservation Service has likewise set up a number of research units to study the hydrologic effects of cover and soil conditions on crop and pasture lands.

Quantitative evidence concerning the influences of various types and conditions of forest and range cover and their associated soils upon the hydrologic behavior of watersheds has been accumulating. Some of the highlights of that evidence will now be summarized.

Effect of Cover on Watersheds

The specific measures to be applied to any forest or range watershed depend, of course, upon the principal objectives that are sought. In the eastern part of the country, where precipitation is generally adequate and well distributed over the year, the main objective is to reduce the severity of floods caused by sudden heavy storms, by prolonged rainfall, or by rapid snow melting. Another important objective is to improve the quality of water by reducing its turbidity and sediment load. Periodic water shortages caused in part by rainfall deficiencies also arouse interest in the application of watershed management.

The first and most obvious effect of forest or range cover on a watershed is the interception of precipitation by foliage and branches before it reaches the ground. The amount of water intercepted varies greatly — depending on whether it falls as rain or snow, whether the forest is coniferous or deciduous, and upon the density of the crown canopy. Studies show that forest cover intercepts from 10 to 25 percent of the average annual precipitation, depending on the size and character of the storms and the nature and density of the cover; in certain areas it may be as high as 35 percent. The highest interception occurs in dense coniferous stands in regions of heavy snowfall, and in dense broadleaf stands in regions of frequent summer rains. The deciduous broadleaf species, of course, intercept little precipitation during their leafless season. Where rapid melting of deep snow pack or heavy summer rainstorms contribute to floods — and total water yield is not of pressing concern — a high ratio of interception by the watershed cover is desirable. Herbaceous and brush cover, such as found on range lands, also intercept precipitation, but not as much as forest cover.

Dense stands of coniferous timber retard snow melt to an appreciable extent. By shading the ground from a large part of the sun's rays, the timber stand maintains a blanket of cool moist air over the snow. It also reduces wind velocity across the snow surface. Snow often lingers under heavy timber stands from one to two weeks or even longer than in the open. This, of course, means a slower and prolonged yield of water from the snow pack.

These same factors that retard snow melt also reduce the evaporation of moisture from the forest floor. But in addition to the effects of shading and reduced wind velocity, the litter (leaves, needles, twigs and other organic material) on the forest floor is an effective insulator that retards evaporation of moisture from the soil. Precise measurement of what the reduction of evaporation losses may be is, however, very difficult because plants also transpire water to the atmosphere. An elm tree of average size, standing where soil moisture is plentiful, may transpire about 1,800 gallons[18] of water from its leaves in a hot, dry, summer day. Such evidence as we now have, indicates that annual transpiration of upland forest stands in the United States varies from a minimum of about 5 inches[19] up to about 15 inches[20] — but may go as high as 35 inches[21] in heavy stands in the more humid parts of the country.

It is well established that transpiration is an important factor in the disposal of water after it enters the forested soil. If the objective of watershed management is to get rid of excessive precipitation which would otherwise cause flood damage, a high rate of transpiration is not at all objectionable. If, on the other hand, a maximum yield of water from the water-

[17] See *Unasylva*, Vol. V, No 1, C.R. Hursh, "Research in Forest–Streamflow Relations." [18] 6,800 liters. [19] 127 mm. [20] 380 mm. [21] 890 mm.

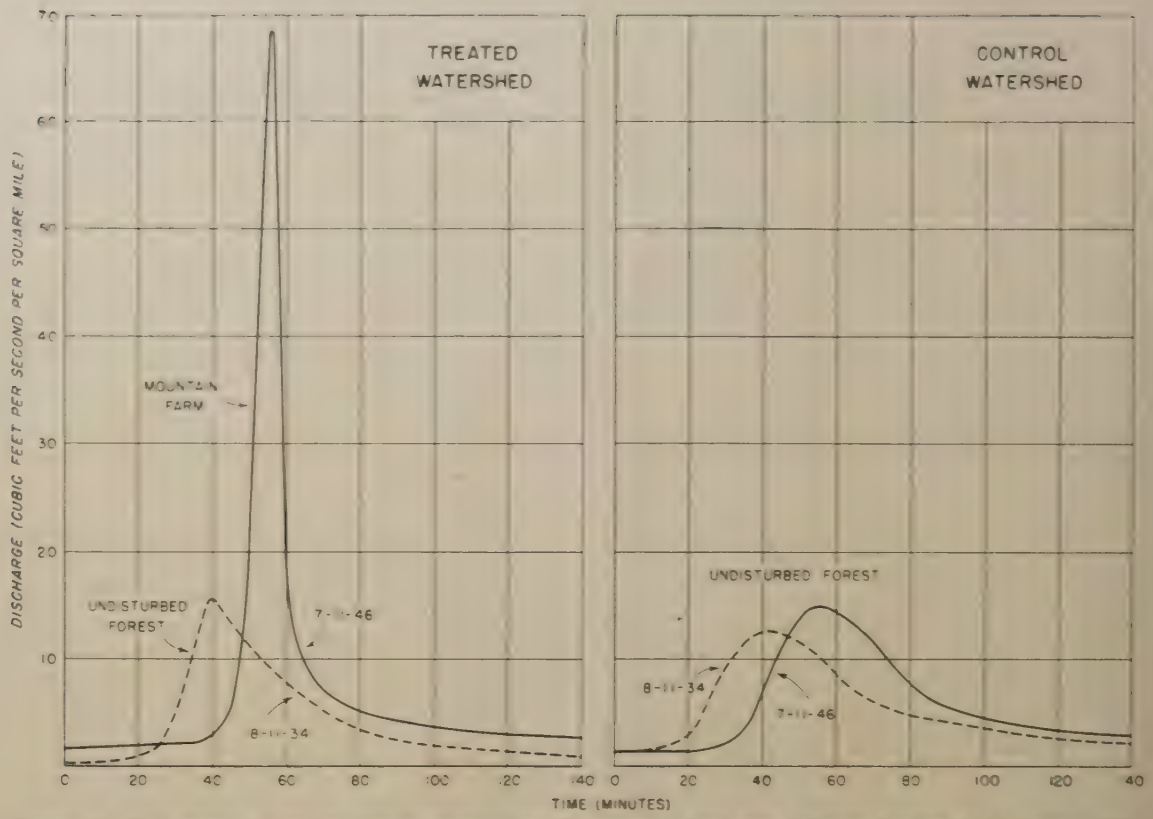


FIGURE 4. *Hydrographs of two neighboring watersheds in the Coweeta forest cover taken on the storm of 11 August 1934, as shown by the dotted lines. Hydrographs for the same two watersheds following the storm of 7 July 1946 after one of them had been converted into a mountain farm, as shown by the solid lines. Note the large increase in peak discharge from the mountain farm. Coweeta Hydrologic Laboratory information.*

By courtesy of the U.S. Forest Service

shed is desired, reduction of the forest cover will generally increase the volume of water reaching streams. This point will be discussed more fully later.

The various factors so far mentioned (interception, rate of snow melt, evaporation, and transpiration) are, however, not any more important than the influences that vegetative cover has upon the relationships of water and soil. In other words, what happens above ground on the watershed is not more vital than what happens below the surface of the soil mantle. The one affects the other.

The violent effects of a complete removal of forest and herbaceous cover from mountain land has been demonstrated at the Coweeta Hydrologic Laboratory. Figure 4 shows the hydrographs of two neighboring small watersheds. Prior to 1939 both of these watersheds were covered with a 40-year old stand of timber. The dotted lines show the close similarity of stream discharge from the two watersheds from a storm that occurred on August 11, 1934. Peak discharge for one watershed was 15 cubic feet per second per square mile [22] of the watershed; for the other it was 12 cubic feet per second [23].

This relationship was typical for similar recordings that had been made over a period of years. Beginning in 1939, one of these experimental watersheds was cleared of timber and converted to a mountain farm. About one-fourth of this farm was plowed and planted to corn; half of it was used for cattle pasture; the remainder was too rough for farming use. For several years the farming was moderately successful but signs of accelerated erosion increased as the organic content and porosity of the top soil diminished. Productivity began to decline. The hydrologic effect of the change from forest to farm use was rather dramatic. A storm occurring on 11 July 1946 produced a peak run-off of 68 cubic feet per second per square mile [24] from the farm, but only 16 cubic feet [25] from the neighboring watershed still in forest cover. This heavy run-off from the farmed watershed carried a large quantity of sediment and left the cultivated land in a gullied condition, so bad that further effort to grow crops on it for commercial purposes was no longer possible. The unhappy results of improper land use, here demonstrated experimentally, are typical of what has occurred on millions of acres of land throughout the United States.

Detailed knowledge of what takes place when vegetative cover is destroyed or removed from the soil has been accumulating. The first effect is a reduction of infiltration capacity – the sustained rate at which water can pass downward through the topmost inch or two of

[22] 0.0016 m.³ per ha. [23] 0.0013 m.³ per ha. [24] 0.0074 m.³ per ha. [25] 0.0017 m.³ per ha.

the soil. Where, for one cause or for many, the possibility for quick infiltration is impaired, overland flow results and this causes rapid run-off frequently accompanied by erosive action. A deep layer of forest litter or a mat of herbaceous growth on top of the soil absorbs a large part of the mechanical force of falling raindrops which otherwise strike the bare soil and start the movement of its particles. Such movement causes the finer particles to be washed into the minute openings, thereby blocking the downward movement of the water. The covering of litter or grass on top of the soil feeds the moisture more gently to the underlying soil surface and prevents the clogging of its pores.

Decaying organic matter (because of its sponge-like properties) also promotes the passage of water through the upper layers of a soil. Infiltration is also aided by the activity of soil flora and fauna (partly microscopic) which thrive in it under the forest litter – especially under the litter laid down by the broadleaf trees and by shrubs and herbaceous growth. These organisms are continually making passageways through the soil, which serve as openings for the entrance of water. The roots of trees and of grasses and other plants also loosen the soil, and as they die and decay they leave humus-filled conduits for the downward movement of water.

Certain factors inhibit infiltration. One of the worst of these is compaction of the soil surface, caused most frequently by excessive grazing of the land or by use of heavy logging machinery. Another hindrance to infiltration is soil freezing, which occurs in several forms — concrete, honeycomb, granular and stalactite. The concrete type of soil freezing is the only one that is impervious to water. Experiments have shown that concrete freezing occurs earlier and goes deeper in open land than in forest-covered land. The older timber stands have less of it than young stands. It forms more readily under coniferous stands than under broadleaf stands.

Disturbance of the forest floor by fire, grazing or logging is conducive to the formation of concrete frost. In the northeastern, central, and southeastern parts of the country this soil freezing factor is of considerable importance in watershed management because floods are often caused by rapid snow melt or by heavy rain on frozen ground. One of the worst inhibitors of infiltration is a severe fire which consumes all of the organic material on top of the soil as well as the humus that is near the soil surface. Excessive run-off and erosion is often the result of severe burns, especially on land that is burned over repeatedly in the space of a few years. The worst effects usually occur in the more arid sections where vegetative cover is naturally light and the organic content of the top soil is low. If vegetation is slow in getting re-established, the damage done to the watershed by fire is likely to be serious. Watersheds bearing a heavy stand of timber or other plant growth are often not seriously damaged by a single fire, providing the organic matter on the ground is not entirely consumed and providing the plant cover is restored rather promptly.

Soil exposed by the cuts and fills in road building usually has a low infiltration capacity and is often a serious source of run-off and erosion. Roads also act as gutters to intercept subsurface flow and thereby accelerate the concentration of water that has fallen on the land. An experiment carried on at the Coweeta Hydrologic Laboratory showed that the road and skid-trail system commonly used in logging operations caused a considerable increase in peak discharge of a logged-over watershed. The turbidity of the water flowing from this watershed averaged 94 parts of suspended solids per million. The water from a neighboring undisturbed watershed averaged 4 parts per million. The maximum turbidity acceptable for drinking water is 10 parts per million. Much remains to be learned about the roadbuilding methods and location that will cause the least damage to watershed values, and about methods for stabilization of road cuts and fills. The proper disposal of water from road drainage is also an important problem that has received too little attention. Too little of the knowledge we do have is being applied. In the forest-range country, heavily-used livestock driveways are also a critical watershed problem. Trampled to a dust bed during the dry season, they are then easily eroded during the wet season. This sequence is repeated year after year. Meadows and lands bordering the streams are often badly damaged by overgrazing.

After water has entered the soil, some or all of it is held there by the molecular attraction of the soil particles (depending on the dryness of the soil); any additional water moves under the force of gravity to some surface outlet or aquifer. Water retained in the capillary soil pores against the force of gravity is said to be in retention storage. The amount so held depends on the depth and other physical properties of the soil mantle. Clay soils, because of the greater surface of their smaller soil particles, retain more water than sandy soils. A soil rich in organic matter retains more water than one with a low organic-matter content. On the average, a clay loam soil retains about 3 inches of water for every foot[26] in depth. A soil mantle of this kind six feet[27] deep will be likely to retain about 18 inches[28] of water. Water held in retention storage is not available for stream flow. It is available for use of plants — in fact, it is their principal source of water most of the time. Water in retention storage is also subject to depletion by evaporation.

In areas where flood control is the main watershed problem, a heavy cover of deep-rooted plants not only prevents surface runoff and erosion and induces infiltration and percolation, but also serves as a pump to put water back into the atmosphere by transpiration. This process goes on all the time but speeds up during the season when the plants are in leaf and growing. The soil reservoir is therefore continually being drawn down and put into condition to hold more storm water. When all the retention-storage space is fully occupied, the watershed is said to be at field capacity. After this occurs, there is still storage space for moving water.

This water that moves as underground flow is, of course, the source of all the perpetual-flowing streams and recharging aquifers. In contrast to overland flow, which is intermittent with the recurring storms and is usually silt-laden, the underground flow is more constant and is clear and cool. It is the more valuable part of the water yield. The yield of a watershed in underground flow is partly dependent upon geological and other factors that cannot be modified by watershed management. But it also depends to a substantial

[26] 250 mm. per m. [27] 1.8 m. [28] 460 mm.

extent upon infiltration and percolation, depth of soil mantle, humus content of the soil, and upon the extent to which retention storage has been depleted. All of these last-named factors can be influenced in a significant way by land-use practices.

Examples of Forest and Range Watershed Protection and Improvement Work

The most important achievements of forest and range watershed protection and improvement in the United States are in those measures that also serve other purposes — protection of forests from fire and pests, reforestation of denuded and poorly stocked land, timber cutting practices that permit prompt natural regeneration of timber stands, logging practices that minimize destruction of the residual stand and minimize soil loss through erosion. Varying progress has been made in getting these practices adopted but we still have a long way to go before any of these are adequate for good watershed management.

On range lands there have also been some improvement measures that contribute to watershed management even though designed principally for other purposes. Considerable effort has been made to obtain more even distribution of grazing animals and thus prevent over-grazing of land adjacent to natural sources of water. This has been done, to a limited extent, by development of supplementary watering places, by fencing, and by various other measures. Some progress has been made in the timing of grazing on range lands in order to prevent undue trampling of wet ground and to allow adequate seeding of range plants. A start has been made in the reseeding of range land on which natural forage has been badly depleted. All of these measures contribute to soil stability and more satisfactory streamflow conditions.

Our main interest at this point, however, is to describe some of the more specialized efforts that have been made to remedy certain critical watershed conditions that have developed in various parts of the country. Three projects of this kind will now be described:

North-central Utah

The project whose results are most striking is located in north-central Utah about fifteen miles[29] north of Salt Lake City. This area was settled about a hundred years ago. Several small towns and about fifty farms were established on alluvial soil near the base of the Wasatch Mountains. The farming land and townsites were located on what was once the bed of Lake Bonneville — a large ancient body of water which receded from ten to twenty thousand years ago to the remnant which is now known as Great Salt Lake. A supply of fresh water for these towns and for irrigation of the farm lands came from several small creeks that drain some 25 square miles[30] of steep mountain land lying immediately east of the settlement. These streams maintained their flow throughout the year, with some increase as the snow on the mountains melted during the spring. Heavy summer storms on the mountains are a normal occurrence but these produced only minor increase of the flow.

Beginning about 1910, the water regimen began to change. Instead of the gentle increase of streamflow coming from these summer storms, the streams began to carry larger volumes of water heavily laden with mud, rocks and other debris. This trend got worse year after year bringing increasing damage to the towns and farm land. In 1923 great quantities of mud and boulders spewed out of the stream mouths causing heavy damage to homes, farms, highways and irrigation ditches. Six persons were killed. In some places the debris was so deep that it could not be cleared away. Other floods of similar nature followed. By 1930 the accumulated damages were estimated at $1,000,000. Property was being abandoned and people were moving away. At this juncture the Governor of Utah appointed a commission to investigate the flood situation.

The Commission found no evidence to show that the summer storms were any worse than normal and no evidence that floods of this kind had occurred in the long interim between the recession of Lake Bonneville and recent years. Examination of the watershed high up on the mountains showed that the flood waters came chiefly from areas on which the plant cover and litter had been destroyed by fire and by excessive grazing. These flood-source areas amounted to only about 10 percent of the entire watershed but they were enough to dump large volumes of water into the stream channels and thereby produce the floods (Figure 1).

Once the causes of the floods were understood, it was easier to find the remedy. Some rather drastic measures were necessary and the people proceeded to take them. The first involved exclusion of all grazing. This was done by purchase of the watershed land, partly by private initiative and partly by public agencies. The publicly-acquired land was made a national forest unit. The next step was an intensification of fire protection to prevent any further destruction of the vegetative cover. The final, and by far the most costly step, was a treatment of the flood-source areas. This involved the construction of contour trenches at intervals of about 25 feet[31], each large enough to hold about an inch and a half of run-off (Figure 2). On slopes of less than 50 percent, these were roughed out by bulldozer and then finished by hand work with cross dams every 20 to 40 feet[32]. On the steeper slopes the work had to be done with horse and plow and then finished by hand. As the contour trenches were installed, they were sown with a mixture of perennial grass seeds by broadcasting on the loose soil and raking the seed in. This new vegetation took hold rapidly and soon covered the raw soil exposed by trench construction (Figure 3).

The effectiveness of this rehabilitation job has now been thoroughly tested. The mud-rock floods have been stopped. Storms more intense than any that caused those floods have occurred several times since the work was completed. There has been no destructive surface run-off from the flood-source areas that were fully treated.

While this project involved a total cost of about $300,000 — including the purchase price of the entire watershed — it has stopped damages which within seven years time had amounted to $1,000,000. So long as the protective cover and improved soil conditions are maintained, it will give permanent protection and secu-

[29] 24 km. [30] 6,480 ha. [31] 7.6 m. [32] 6-12 m.

rity to a whole community embracing values of many millions of dollars. The value foregone by exclusion of grazing on the watershed is small in comparison with those values which are now protected.

Northwestern Mississippi

Another project, especially designed to rehabilitate a badly-damaged watershed, includes the Yazoo River basin of northwestern Mississippi. This is in the humid section of the country. Precipitation averages about 52 inches[33] per year and is fairly well distributed. The Yazoo River drains about 6 million acres[34] of land, lying in the shape of a triangle based on the Tennessee-Mississippi State line and pointing southwestward. The main stem of the river occupies an ancient flood plain of the Mississippi River extending along the western side of the watershed. This is deep alluvial soil. Eastward, in successive belts that extend the full length of the watershed, there are zones of wind-deposited loessal soil overlying sand, brown loam, and heavy clay. Settlement began about 125 years ago amid dense stands of conifer and broadleaf timber. Streams ran clear and carried little sediment to the valley lands.

Clearing went forward rapidly, first on the better-drained lowlands and flat uplands, then on the steeper uplands and poorly-drained lowlands. Cotton and corn were the chief crops under a tenant and sharecrop system. Sawmills began to move in about 1900. By 1930 most of the virgin timber had been cut. Fire repeatedly swept the cut-over areas and left the residual stands in poor condition. Excessive grazing of both the farm and non-farm lands brought further depletion of the vegetative cover, compacted the soil, and impaired its infiltration, percolation, and waterstorage capacity.

The results of unwise land-use in the Yazoo River basin make a sad story. Destructive floods, heavy sedimentation of the lowlands, and destruction of the uplands by gullying are common occurrences.

More than 300 floods occurred in the basin during the period 1929-1941. Several were bad enough to get national attention. Farm family income fell to a level far below the national average.

In 1944 Congress authorized a program of watershed rehabilitation. This included:

(*a*) installation and operation of an effective fire control system, which had not existed previously;

(*b*) reforestation of some 300,000 acres[35] of worn-out farm lands;

(*c*) a program of technical service to assist private forest landowners to improve the management of their timber stands;

(*d*) control of grazing by means of fencing and other measures;

(*e*) fertilization of pasture lands and reseeding with improved forage such as Bermuda grass, lespedeza and white clover;

[33] 1,320 mm. [34] 2-4 million ha. [35] 120,000 ha.

FIGURE 5. *The head of a formerly active gully in the Yazoo river area stabilized by tree planting. A deep carpet of grass and litter under the trees stops soil movement.*

By courtesy of the U.S. Forest Service

(*f*) terracing and strip-cropping on sloping land used for crops;

(*g*) a sound system of crop rotation to replace the common practice of trying to grow cotton and corn on the same ground year after year;

(*h*) installation of grassed waterways to dispose of surplus water from fields, pastures and roads;

(*i*) revegetation of exposed soil on roadbanks and railroad grades.

Supplementing these land-treatment measures, there were also plans for construction of check dams in the gullies and various other small structures to retard runoff and trap sediment.

As originally planned, this program was to be installed in fifteen years. The funds appropriated have not been sufficient to keep on schedule, but despite this handicap, very substantial progress has been attained. The area burned over annually has been reduced to less than 1 percent of the total forest land. Some 16 million trees were planted in 1952 and 35 million will be planted in 1953. Much of this planting has been done in small patches to check the worst erosion sores (Figure 5). The planted patches will soon be seeding the intervening land. Small earth dams and other simple structures have been built at key locations in the tributary channels to reinforce the land-treatment measures while the latter are gradually developing their full effectiveness. Road-bank stabilization, pasture improvement, strip-cropping and crop rotation have also gone forward in a way that is encouraging. Substantial reduction of sediment from the treated areas is clearly in evidence. Improvements in streamflow regimen will follow as the vegetative cover is restored.

Colorado

A quite different kind of project is located high in the Rocky Mountains near Fraser, Colorado. The waters from this area are greatly needed for irrigation of lands in Arizona and California and for the municipal water supply of the metropolitan area of southern California. The main objective of watershed management is to obtain the maximum yield of water that can be had without causing erosion damage. The early experiments at Wagon Wheel Gap showed that water yield could be increased by some 15 percent by removal of the woody vegetation. Soil conditions were such that the herbaceous cover was capable of giving the necessary protection against erosion. The research program near Fraser has been designed to undertake plot experiments and then to test them on a pilot watershed scale. In one series of plots stands of lodgepole pine timber were cut so as to leave five different densities. At the one extreme was the uncut forest, and at the other was a stand from which all trees larger than 10 inches[36] diameter at breast height had been removed. Measurements of snow pack, rate of melting and evaporation-transpiration losses were kept for six years after the cutting operations. The results showed a substantial increase of water available for streamflow. The uncut forest plot yielded 10.3 inches[37] of water; the plot cut most heavily, yielded 13.5 inches[38]. This represented a gain of 30 percent in the amount of water that entered the soil. Now the experiment has been expanded to a 710-acre[39] pilot watershed to determine the actual effects of logging on erosion, peak flows, and water yield. There is good possibility that this kind of management can be applied to a fairly large area of high-altitude watershed lands in the West. It would, however, have to be applied with the utmost care and limited to those lands which are naturally stable and not easily damaged.

Conclusion

The importance of water management in the economy of the United States is being recognized to an increasing degree. Very large investments in engineering works to control and utilize water have been made, and even larger works are being planned. However, the effects of vegetative cover and soil-mantle conditions on watersheds and thereby on stream regimen have also been recognized in a long series of laws relating to forest, range, and open lands, and substantial accomplishments in the protection and improvement of watershed lands have already been made through measures adopted primarily for other purposes. In large areas, however, these measures have still not been adequate to give the needed protection and improvement.

Specialized research on watershed management problems, particularly those relating to the effects of land use practices on water yields, has been underway but, so far, on a very modest scale. A considerable body of technical knowledge has been developed and more will be forthcoming as greater public awareness of the need for such knowledge continues to develop. Several outstanding examples of successful rehabilitation of badly-damaged watersheds are now at hand. These, however, are only a scratch on the surface of a very large task that remains to be done.

[36] 25 cm. [37] 26 cm. [38] 34 cm. [39] 290 ha.

FAO Staff Appointment

Thorsten Streyffert, Rector of the Royal School of Forestry, Stockholm, Sweden, has assumed the appointment of *Chief, Economics Branch, Forestry Division, FAO*. He was recently made Honorary D. Sc. of Göttingen University, Germany.

Commodity Reports

Wood Pulp

This report reviews the main events in the wood pulp market in 1952. *It deals mainly with North America and Western Europe, which account for about nine-tenths of world production and consumption of wood pulp, and for which the latest available statistics are more recent. It refers to events in the paper and board market which had bearing on the market for wood pulp.*

In the world pulp market, the year 1951 was a period of rising production, unsatisfied demand, soaring prices and a high level of international trade. The year 1952, in marked contrast, was on the whole a year of lower production, lagging and hesitant demand, collapsing prices and reduced trade.

It could be said that 1952 marked the first post-war recession in the pulp and paper trade. Its impact was uneven; while board and wrapping grades of paper suffered a sharp setback, production and demand for newsprint were well-maintained. Most of Western Europe was affected, the Scandinavian countries, dependent on exports, seriously so. The effects were much less serious in Canada and the U.S.A. In Japan, the biggest producer of pulp and paper outside Europe and North America, output continued to rise.

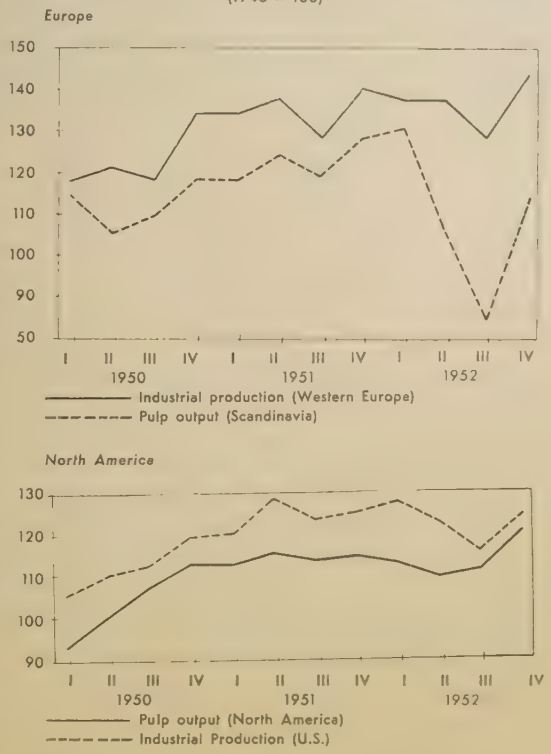
The recession can be traced to two main causes, whose effects overlapped. The unprecedented high level of pulp prices in 1951 communicated itself, with short time lags, first to paper and board and then to paper and board products. As demand cooled, the effects were transmitted back along the demand chain to the pulp mills. This natural and perhaps inevitable reaction to the 1951 price inflation was not, however, the only operative factor. 1952 brought a slackening in the rate of increase of general economic activity and in some countries an absolute decline. These setbacks were reflected in a sharp fall in the demand for certain pulp products which in turn reacted on the demand for pulp.

TABLE 1. INDICES OF INDUSTRIAL PRODUCTION AND OF PULP OUTPUT, 1950-52
(1948 = 100)

Year	Europe		North America	
	Index of industrial production in western Europe	Pulp output in three northern countries	U.S. index of industrial production	Pulp output in U.S.A. and Canada
1950	124	113	104	112
1951	136	123	115	125
1952	137	109	114	123

The figures in Table 1 show that, in both North America and Western Europe, industrial output rose by about 10 percent between 1950 and 1951. Over the same period pulp output rose by about the same amount in both North America and Scandinavia. From 1951 to 1952, industrial production fell slightly in North America and was accompanied by a similar slight fall in pulp output. In Western Europe, however, industrial production rose slightly while Scandinavian pulp output

DIAGRAM A
Quarterly Indices of Industrial Production and Pulp Output (1950-52)
(1948 = 100)



fell 11 percent below the previous year's level. Because the Scandinavian pulp industry is largely directed to the export market, it was more sensitive to the recession. Moreover, the trend of economic activity in the United Kingdom, Scandinavia's most important customer, was different from that in the rest of Western Europe. The U.K. index of industrial production averaged 120 in 1951 and 116 in 1952, as against 115 in 1950 (1948 = 100); the corresponding figures for the rest of Western Europe taken together were 145 and 150, as against 129 in 1950.

The annual indices given in Table 1 conceal important variations, as may be seen from the corresponding quarterly indices presented in Diagram A.

In the last quarter of 1952 industrial production in both North America and Western Europe markedly increased, exceeding the levels of the corresponding quarter of 1951. In both North America and Scandinavia there was a sympathetic upswing in pulp output, the significance of which is discussed below.

The demand for pulp is a function of the demand for paper and board. There are, however, many categories of paper and board, and the demand for each is influenced by a variety of factors, some common, but many special to the category concerned. The quarterly figures of U.S. production of certain grades of paper and board given in Table 2 show that output of coarse paper and container board (grades used for packaging) declined earlier and more steeply than that of fine paper, while newsprint output was well maintained.

TABLE 2. — QUARTERLY U. S. PRODUCTION OF CERTAIN GRADES OF PAPER AND BOARD
(in thousand short tons)

Year		Newsprint	Coarse paper	Fine paper	Container board
1951	I	270	874	328	1 681
	II	279	895	349*	1 770
	III	275	878	323	1 512
	IV	282	950	364	1 384
1952	I	281	920	373	1 384
	II	283	797	332	1 361
	III	284	718	285	1 409
	IV*	274	799	295	1 616

*) Provisional

Packaging paper and board is used in almost every sector of the economy. Frequently it represents a considerable element in production costs and materials stocks. When business is expanding a higher level of packaging stocks is necessary than when business is at a stable level. If business contracts, or if the rate of expansion is reduced, stocks are cut back and this tendency is all the stronger if replacement costs are falling. The aggregate effect of these thousands of individual decisions is transmitted backwards along the chain of demand to the paper and board converters, the paper and board mills, the pulp mills and, ultimately, to the pulpwood market. There is a time lag in the process of backwards transmission as inventories in the earlier stages take the shock of changes at the consumer end of the chain. To some extent there is a diminution in amplitude since, for example, cheaper wood pulp replaces waste paper and other fibrous materials in paper-making. Moreover, consumer demand was first and most markedly reduced in paper and board categories with a relatively low pulp content. A high degree of integration in the pulp and paper industry also has the effect of damping down oscillations, since it enables decisions to be taken earlier and operated more swiftly. It would be wrong to dismiss the events of 1952 as simply the downswing of an inventory cycle. There was a decided check in general economic activity, bringing a contraction in demand. Reduced normal demand, aggravated in the case of the U.S.A. by reduced defence buying, led to sharp inventory changes which were reflected back along the chain.

The events of 1952 suggest that current short-term data concerning fluctuations in the physical volume of packaging stocks held by consumers would represent a useful economic indicator to the whole pulp and paper trade. So far little or no information is available, and indeed it is not easy to collect. Another category of information, which would be of value in interpreting short-term trends, would be the relations between the physical volumes of packaging stocks in the hands of consumers and of materials for packaging in the hands of converters on the one hand, and the monthly output of the paper and board mills on the other.

That the demand for packaging paper and board is specially sensitive to changes in the economic climate is also borne out by the movements in paper and board production in the United Kingdom. The fall in the output of packaging paper and board started earlier, and was much steeper, than that of other paper grades. Again newsprint output suffered least.

Although there were some parallels in the evolution of the pulp and paper industries in North America and Europe, the situation in Europe is a good deal more complex and the market followed a more spectacular course. The North American continent is roughly self-sufficient. It imports certain qualities from Europe, but there is no large spill-over of demand save when domestic supply is inadequate to meet an exceptionally high level of domestic demand. The paper recession in the U.S.A. brought a decrease in pulp demand and imports became less urgent. Prices, still controlled, remained fairly steady on the whole, only unbleached sulphate pulp, wrapping tissue and certain grades of board showing marked drops between September 1951 and September 1952.

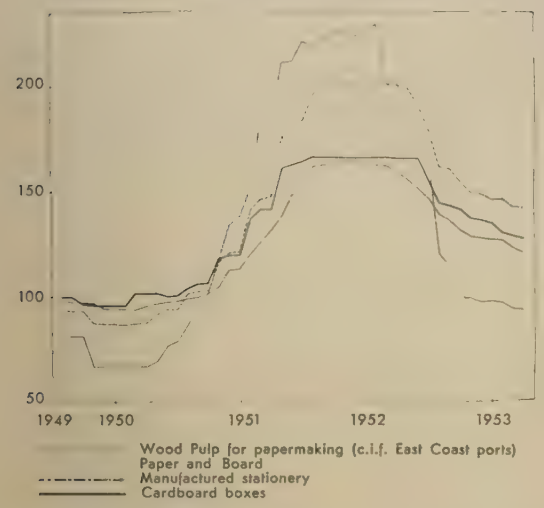
In Europe, too, there was a slackening in economic activity, and a consequent recession in the paper and board industry. But the pulp market became critical some months earlier.

First, it should be noted that in Europe the vast majority of pulp produced is for the market. The biggest paper producers depend largely on imported pulp. Only Austria and the three Northern countries have a considerable export of pulp. To the Scandinavian countries these exports are vital. In 1951, world demand for forest products exceeded the available supply and prices rose to unprecedentedly high levels, none more so than that of wood pulp. The course of pulp prices is exemplified by the movements in the U.K. Board of Trade wholesale price index for wood pulp for paper making, illustrated in Diagram B.

The steep rise in pulp prices, which reached their maximum in January 1952, may have been enhanced by the export taxes imposed by the Northern countries, though the avowed purpose of these taxes was to serve as equalization charges. The reaction of the chief European importers, embarrassed by renewed balance-of-payments difficulties, was to set import price ceilings. The example of Britain and France was followed, unof-

DIAGRAM B

Wholesale Price Index Movements in the U.K., 1949-53
(June 30, 1949 = 100)



ficially, by other importers. Buying was checked, production curbed, consumers began to live partly on stocks. Wide fluctuations in prices are anathema to consumers as to producers, and the hope prevailed that as stocks returned to a more normal level and as pipelines needed to be refilled, prices would stabilize at a level acceptable to both buyers and sellers—perhaps somewhere near the import price ceilings imposed. However, before this hoped-for development could take place, a slowing down of industrial progress brought difficulties in the paper and board industries and a genuine falling off in demand. In Britain, paper and board imports were cut; in France, previously lifted import duties on pulp products were reimposed. Demand for pulp did not revive and the pulp price fall continued unchecked. Not until the last quarter did prices show signs of flattening out, and by then it was generally conceded that they were well below current production costs, many elements of which are temporarily fixed (roundwood prices, for example) or rigid (e.g. wages). In the latter half of the year output was voluntarily restricted, many mills in Scandinavia working short time and others closing down altogether. But hopeful signs, for which the Scandinavian producers sought anxiously at the turn of the year, were not altogether lacking.

Salient Features of 1952

The main figures of wood pulp production and trade in 1952 are compared with those of the two preceding years in Table 3.

Estimated world pulp production in 1948 and 1949 was around 29-30 million metric tons. In 1950 it rose to 33½ million tons and in the following year attained an all-time high of 37 million tons; last year it fell back to 36 million tons. The decline was most severely felt in the Scandinavian countries, where production fell by 930 thousand tons, but output was also down in the rest of Europe (by 150 thousand tons), in Canada (by 180 thousand tons) and in the U.S.A. (by 60 thousand tons). Imports also fell by a million tons as compared with 1951, the biggest drops being recorded in Europe (550 thousand tons) and the U.S.A. (390 thousand tons). The main burden of the reduced export trade was borne by the three countries of northern Europe, whose exports fell from 3,760 thousand tons in 1951 to 3,030 thousand tons in 1952, a fall of about 20 percent. Canadian exports fell, too, by 270 thousand tons, but exports from the U.S.A. rose slightly as easing demand weakened the priority hitherto given to domestic buyers.

In spite of the setback in world pulp output, it is interesting to note that production was still over 2½ million tons greater than in 1950.

TABLE 3. — WORLD PRODUCTION AND TRADE IN WOOD PULP, 1950-52
(in thousand metric tons)

Region	1950				1951				1952			
	Production	Imports	Exports	New supply	Production	Imports	Exports	New supply	Production	Imports	Exports	New supply
Europe:	9 916	3 090	3 970	9 036	10 697	3 486	4 044	10 139	9 714	2 885	3 251	9 348
of which 3 northern countries	*6 087*	*22*	*3 701*	*2 408*	*6 639*	*23*	*3 763*	*2 899*	*5 806*	*9*	*3 030*	*2 785*
U.S.S.R.	1 600	..	..	1 600	1 800	..	..	1 800	2 000	..	..	2 000
U.S.A.	13 471	2 164	87	15 548	14 964	2 145	183	16 926	14 900	1 755	196	16 459
Canada	7 462	33	1 662	5 833	8 152	33	2 021	6 164	7 970	42	1 751	6 261
Latin America	180	317	..	497	184	329	..	513	200	280	..	480
Asia (excl. China)	724	74	..	798	1 012	128	..	1 140	1 170	80		1 250
Africa	33	8	..	41	35	11	.	46	35	5	..	40
Oceania	154	44	..	198	154	37	..	191	165	45	..	210
APPROX. WORLD TOTAL	33 500	5 730	5 720	33 500	37 000	6 170	6 250	36 900	36 200	5 090	5 200	36 100

Table 4. World Production and Exports of Wood Pulp 1950-52

Year	Wood pulp production: Quantity (million metric tons)	Wood pulp production: Percentage of 1950	Wood pulp exports: Quantity (million metric tons)	Wood pulp exports: Percentage of 1950
1950	33.5	100	5.72	100
1951	37.0	110	6.25	109
1952	36.2	108	5.20	91

Trade in wood pulp, however, fell by about a million tons — to a level half-a-million tons below that of 1950. Even when allowance is made for the exceptional fluctuation in the world's pulp trade during the last three years, it is clear that one result of the post-war efforts made to raise pulp production in all areas has been to increase regional self-sufficiency. Just as the progress of integration has diminished the relative importance of market pulp on the national level, similarly the need to secure supplies for domestic industry of this essential raw material has reduced the importance of the pulp trade in relation to world pulp output. Imports of pulp for many countries (though, of course, there are several notable exceptions) take on an increasingly marginal importance. Alongside this development, the situation of those countries whose economic life depends on pulp exports becomes increasingly vulnerable to fluctuations in world demand.

North America

United States

The United States wood pulp industry enjoyed a good year in 1952. Although U.S. production of paper and board, at 22.1 million metric tons, was down by 6 percent as compared with the previous year, wood pulp consumption fell only from 16.8 to 16.3 million tons, i.e. by half a million tons, or less than 3 percent. Since pulp stocks increased during the year by 145 thousand tons, or about the same as in 1951, and since imports fell from 2.14 to 1.76 million tons, the level of pulp production in 1952 was a mere 55 thousand tons below that of the previous year.

Thus, in spite of the pronounced recession in the paper industry, pulp production was well maintained, for a variety of reasons. Exports of paper and pulp increased slightly as the pressure of domestic demand eased. The fall in paper production occurred chiefly in categories with a relatively low pulp content. As the price of pulp fell, paper makers used less waste paper and more wood pulp. In the first 9 months of 1952, consumption of waste fibrous materials, at 5.2 million metric tons, was 20 percent below that of the corresponding period of 1951. Less pulp was imported from overseas. The decline in pulp imports over the year was, in fact, considerably less than at one time seemed likely; in the latter half of the year the price of imported pulp fell to that of domestic pulp and imports from Scandinavia began to revive. After July, there were signs of an upturn in paper demand and production and the pulp market strengthened.

The salient figures of the American wood pulp market in 1952, with comparable figures for 1951, are given below.

Table 5. — Wood Pulp Balance, 1951-52
(in million metric tons)

	1951	1952
Supply:		
U.S. production	14.99	14.93
Imports from:		
Canada	1.70	1.43
Europe	.44	.33
Total	17.13	16.69
Consumption and Exports		
Exports	.18	.19
Consumption	16.81	16.36
Additions to stock	0.14	0.14
Total	17.13	16.69

No serious raw material shortages hampered the pulp and paper industries during 1952. The shortage of chlorine had disappeared in the previous year and the world shortage of sulphur was overcome in the course of the year. Paper making is the largest consumer of this mineral in its natural form, but sulphur output rose steadily and early in 1953 the International Materials Committee was able to announce the ending of allocations and the dissolution of the Sulphur Committee.

Though the rapid rise in pulp output was halted in 1952, capacity continued to expand. Eight new wood pulp plants were put into operation in the course of the year and the construction of three others started. Most of these plants are in the Southern states. If all announced projects are completed, U.S. pulp capacity will rise to 20.3 million metric tons in 1955 as compared with 15.5 millions at the end of 1950. Over the same period, capacity for paper other than newsprint is expected to grow from 11.4 to 12.8 million tons, and that of paperboard from 10.8 to 12.4 million tons.

So far as in known, the 1952 recession has not led to any slowing down of these development projects. At the end of the year there was less fear that a tapering off of defense expenditures would bring difficulties in the latter half of 1953 and the pulp and paper industry looked forward to a year of resumed progress. In recent months, the prospects of the armistice in Korea and the possible economic consequences of a wider political *détente* have introduced a note of uncertainty but, at the time of writing this report, there is no evidence of diminished optimism on the part of the U.S. pulp and paper industry.

A recent U.S. Department of Commerce report on the Pulp, Paper and Board Industry gives interesting new facts on the progress of integration. Between 1929 and 1951 the volume of market pulp consumption in the U.S.A. rose only from 2.0 to 2.4 million tons, while the consumption of own manufactured pulp rose from 5.7 to 16.1 million tons. In other words, the share of integrated consumption rose from 66 to 85 percent of the total, virtually all the capacity increases in the paper and board industry over the last

two decades taking place in integrated mills. As additional integrated capacity comes into operation this percentage will grow. Monthly data over the last two years suggest that non-integrated mills tend to lose their share in total output on a falling market, regaining it on the upward swing; this provides an indication of the unfavorable economic factors (higher pulp costs, freight, less efficient manufacturing and distributing processes) facing non-integrated mills, whose ability to hold their own depends largely on specialized techniques and based on pre-arranged contracts.

Most of the new projected capacity, it was mentioned above, will be located in the Southern States. This is in line with a notable development of recent years. Between 1947 and 1951 the share of the Southern States in U.S. wood pulp production rose from 48.2 to 53.8 percent, while their share in total U.S. paper and board production rose from 28.3 to 34.2 percent. The coming years will see a further southward shift in the center of gravity of the U.S. pulp and paper industry.

Canada

Canada produces more than half the world's newsprint and accounts for over four-fifths of the world trade in newsprint: 85 percent of her newsprint output in 1952 went to the U.S.A., which consumes nearly three-fifths of the world's total. Thus developments in the Canadian pulp industry depend mainly on the state of the world newsprint market; in particular, they are bound up closely with the level of newsprint demand in the U.S.A.

It has already been noted that newsprint was hardly affected by the world recession in the paper and board industry. Because the Canadian pulp industry is largely devoted to newsprint it felt the impact of the recession only slightly and at second hand, in the shape of reduced pulp exports.

Industrial activity increased in the course of the year; the index of industrial production, which in December 1951 and January 1952 stood at 212 (1935-9 = 100), rose to 248, 248 and 235 in the last three months of the year, giving a yearly average of 233 as compared with 226.5 in 1951.

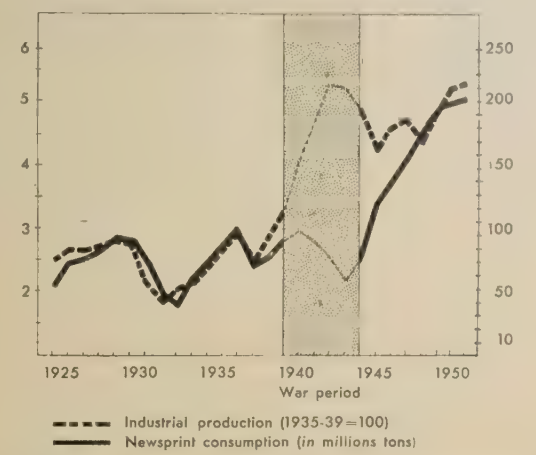
Newsprint output remained remarkably steady throughout the year, and the annual total, 5,161 thousand metric tons, represented an increase of about 3 percent over the 1951 figure. The check to the rise in pulp demand in the U.S.A. brought a reduction in Canada's exports to that country of about 275 thousand metric tons. With the total domestic demand for pulp remaining steady, and little aggregate change in pulp exports to other markets, pulp output for the year totalled 7,955 thousand metric tons as against 8,254 thousand tons in the previous year. The fall of 300 thousand tons, or just under 4 percent, thus corresponded very closely to the reduction in exports to the U.S.A.

Canada's share in world newsprint capacity and output in 1952 was respectively 50.4 and 53.4 percent; its share is likely to increase in the course of the next year or two. New mills, new machines and machine improvements are expected to raise production potential by 1.5 million tons by 1960, with most of this gain concentrated in the next three years. These estimates are based on an assessment of individual expansion plans undertaken at the beginning of 1952, and have been revised in the light of modifications since reported. Though it is true that investment in 1953 will fall considerably below that in 1952, on the whole this development program indicates strong confidence in a continued rise in the demand for newsprint.

As mentioned earlier, no less than 85 percent of Canadian newsprint output was shipped to the United States in 1952, 4,400 thousand metric tons against a U.S. domestic production of 1,060 thousand tons. Since newsprint consumption in the past has moved very closely with industrial activity as a whole (see Diagram C) it is plain that the Canadian newsprint and pulp industry will be very vulnerable to any setbacks in the trend of economic activity in the United States.

DIAGRAM C

U.S. Newsprint Consumption and Index of Industrial Production.



(This chart is published by courtesy of the Newsprint Association of Canada)

Short-range and long-range forecasts of U.S. newsprint demand, from both private and official sources, are, however, uniformly optimistic. They envisage an annual increase in consumption of about 150 thousand short tons in the next decade, subsequently tapering off to about 100 thousand tons. It is clear that current Canadian pulp and newsprint investment plans are based on these optimistic appraisals of future trends.

Europe

For the three countries of Northern Europe which export four-fifths of their pulp output either as pulp or as pulp products, 1952 was a disappointing year. In 1951, for example, pulp exports accounted for 56 percent of their total production and exports of pulp products for 25 percent. In 1952 the export trade suffered a severe setback. In part this was the inevitable harvest of the fantastic rise in pulp prices which started in mid-1950 and continued through 1951. The measures taken by certain pulp deficit countries at the end of 1951 and the beginning of 1952 (import licensing, the imposition of import price ceilings) damped off demand.

Exports to the U.S.A. fell away as a result of the wide disparity between Scandinavian export prices and domestic price-controlled U.S. pulp prices.

Prices began a headlong fall and months passed without any sign of a halt. There was no responsive strengthening in demand. The slackening of economic activity in Europe brought a recession in the paper and board trade, especially in the United Kingdom, Scandinavia's most important customer. With demand further weakened, there was little disposition to renew buying and the fall continued. The U.K. commodity price index (wood pulp for paper-making, c.i.f. East Coast ports), which in January, 1952, stood at 229.5 (June 30, 1949 = 100), had fallen to 103 by November. Many pulp mills started short-time working and a number closed down. There was a voluntary 20 percent contraction in mechanical pulp output in the northern countries. The level to which pulp prices had fallen by the end of the year was generally regarded as being considerably below current production costs, since production has to be based on pulpwood bought at high prices and since wages and other costs had risen since mid-1951.

In the closing months of the year renewed activity in the European paper and board industry, and increased exports to the U.S.A. as lower prices once again made Scandinavian pulp competitive on the U.S. market, seemed to indicate a pending revival. Nevertheless, the Scandinavian producers, in spite of the upward turn in the paper market, were by no means confident of the future and in the early months of 1953 a proposal to limit cellulose production in 1953 to 90 percent of the 1951 output was actively canvassed. By the end of March the plan had been dropped; there were economic and technical difficulties in the way of enforcing an all-round cut, and stocks, though high, (estimated at some 350,000 tons above normal) were not considered disturbingly so. Of more importance, perhaps, was the fact that during these months the economic outlook was gradually changing for the better. An indication of this change was that, in April, sellers were becoming disinclined to make definite price agreements for deliveries in the second half of the year. Even at this date, however, embarrassed by excessive stocks and low order books, a number of mills remained closed.

Meanwhile, the problem of costs remains. Though pulpwood costs have fallen by about 40 percent compared with last year, labour costs are likely to continue unchanged.

Sweden

Swedish deliveries of paper and board in 1952 fell 20 percent below the 1951 total. While deliveries to the home market remained fairly steady and exports of newsprint slightly exceeded those of the previous year, exports of other categories of paper and board fell by 190 thousand tons, or 35 percent. The most serious reductions were in exports to Britain and France, two of Sweden's most important customers, where import restrictions were imposed at the beginning of the year. But even in European markets where no restrictions were in force, falling demand led to reduced trade. Exports to the rest of the world were fairly well maintained with certain exceptions; Australia, the Union of South Africa and Argentina all took much less as a result.

TABLE 6. — SWEDISH EXPORTS OF PAPER AND BOARD, 1951-52

	1951	1952	1951	1952
	1,000 metric tons		Average value per ton f.o.b. Sw. kroner	
Newsprint	198.7	208.4	1 091	857
Kraft papers	252.5	187.1	1 531	1 336
Sulphite wrappings	77.3	43.0	1 751	1 535
Other papers	167.0	97.6	...	...
Paperboard	46.7	25.8	1 362	1 229
TOTAL ...	742.2	561.9		

Along with this 25 percent decline in total paper and board exports, and consequent reduction in domestic demand for pulp, went a 19 percent drop in pulp exports, which fell from 2,011 to 1,628 thousand tons. Details of Swedish pulp exports in 1952, with comparable figures for 1951, are given in Table 7.

TABLE 7. – SWEDISH PULP EXPORTS, 1951 AND 1952

(in thousand metric tons)

	1951	1952
By Grades:		
Mechanical	296	268
Sulphite:		
Dissolving	381	267
Other	672	547
Sulphate	662	546
By Destination:		
United Kingdom	588	509
France	244	219
Belgium	88	68
Netherlands	101	87
Germany	174	130
Other European	322	258
U.S.A.	200	198
Latin America	226	120
All others	68	39
TOTAL ...	2 011	1 628

While exports of mechanical pulp fell by less than 10 percent, cellulose exports fell by 12 percent. Resumed shipments at the end of the year to the U.S. brought total shipments to that country close to the previous year's level, but all other markets took considerably less than in 1951, especially the United Kingdom and Latin America.

In the early months of this year prospects were a little brighter, but there is no likelihood of exports reaching the high 1951 level. British requirements are not yet clear and France's increasing indebtedness to E.P.U. is likely to lead her further to restrict her imports during the coming period. But, in spite of these uncertainties, the pulp and paper market is definitely brisker than it has been for many months past, and though hopes for 1953 are not set too high, there is a general feeling that the low point has been passed.

Finland

As in Sweden, exports of newsprint increased in 1952 while exports of other paper and board declined. Total exports of newsprint for the year reached 392 thousand tons in 1951. The biggest customer was again the U.S.A., which took 144 thousand tons, a slight increase over the previous year. Exports to the United Kingdom rose from 64 to 75 thousand tons; those to Argentina from 5 to 38 thousand tons; while Mexico and China, which did not import from Finland in 1951, each took 10 thousand tons. Exports of other paper, however, fell from 223 thousand tons to 177 thousand tons, in spite of a 23 thousand ton increase in exports to the Soviet Union. A similar fall occurred in exports of paperboard, from 97 to 65 thousand tons.

Demand remains strong for newsprint and, because of this, it figures more largely in Finland's export trade, the decline in total paper and board exports being only 10 percent in Finland, as against 25 percent in Sweden.

Exports of pulp, however, fell by 27 percent. Mechanical pulp exports, which in 1951 had totalled 210 thousand tons, fell by 32 percent to 143 thousand tons, the main reductions being in exports to the U.K. (72 against 120 thousand tons) and France (18 against 33 thousand tons). Chemical pulp exports fell from 982 thousand tons to 722 thousand tons, a drop of 26 percent. The U.K. (288 against 423 thousand tons) and France (67 against 104 thousand tons) were again the markets most affected. The only grade to show an improvement over 1951 was dissolving sulphite, exports of which rose from 52 to 68 thousand tons, thanks to shipments to Poland totalling 24 thousand tons. A notable new customer was China, which imported 16 thousand tons of sulphite pulp.

Thus total pulp production in Finland fell 300 thousand tons below the high level reached in 1951, a fall of 14 percent. Whereas, in 1951, chemical pulp mills worked at 96-97 percent of capacity, in 1952 little over 80 percent of sulphite capacity and only 70 percent of sulphate capacity was used. In common with other northern countries, Finland voluntarily contracted its mechanical pulp output by 20 percent in 1952.

During the past year, Finland shared the apprehensions of the other northern countries at the course of events in the pulp and paper market; with them it took comfort in the more encouraging signs manifest in recent months. It is worth noting, too, that in recent months Finland has signed a number of new or supplementary trade agreements with China, the Soviet Union and Eastern European countries which will lead to an expansion of pulp and paper exports to those destinations over the next few years. Agreements recently signed provide for the following deliveries in 1953:

TABLE 8. DELIVERIES CONTRACTED FOR IN 1953

Country	Pulpwood	Wood pulp	Newsprint	Paper and board
	1,000 m.³	1,000 metric tons		
U.S.S.R.	400	28	10	52
China		20	5	11
E. Germany		5½		2
Poland		43		some
Czechoslovakia		1		some

Deliveries of pulp, paper or board are also provided for in agreements signed with Bulgaria and Hungary. In several instances the deliveries will take place under triangular trade agreements.

Since nine-tenths of Finland's exports consist of forest products and since Finland depends on imports for a third of its bread cereals, most of its iron, steel, industrial chemicals and textile raw materials, and all its coal and liquid fuel, the present level of world prices for forest products is giving rise to considerable concern. Unless manufacturing costs can be brought down, the advocates of devaluation are likely to multiply and become more vociferous.

The timber, pulp and paper price movements of the last three years have had a more significant effect on the Finnish economy than on that of any other country.

Norway

In Norway the economy is less dominated by the forest products industries than in Finland and Sweden. Nevertheless, it was seriously affected in 1952 by the turn in the market. Total Norwegian exports fell from 4,428 million kroner in 1951 to 4,039 in 1952, a drop of nearly 390 million kroner. This was mainly occasioned by a fall of 293 million kroner in the pulp and paper sector. The share of all forest products in total exports dropped from 31 to 26 percent; the share of paper and board fell from over 15 to under 11 percent, while that of pulp about the same as in the previous year — just over 14 percent.

Though newsprint exports fell only slightly, there was a sharp decline in exports of other categories of paper and board, so that for the year exports of all types reached only 261 thousand tons against 332 thousand tons in 1951. Consequently total production of paper and board in Norway fell by 8¼ percent, from 511 to 467 thousand tons. The volume of pulp exports was less affected than in other exporting countries; it was less than 5 percent below the previous year's total. Once again three-fifths of the pulp exported was mechanical pulp, and since Norwegian contracts are customarily longer term than those in Finland and Sweden, in the rapidly falling market of 1952 this brought some difficulties between Norwegian sellers and certain of their customers, notably France.

TABLE 9. — NORWEGIAN PRODUCTION AND EXPORTS, 1951 AND 1952

(in thousand metric tons)

	Production		Exports	
	1951	1952	1951	1952
Mechanical pulp	554	515	335	319
Chemical pulp	529	496	230	214
Paper and board	511	467	332	261

In spite of decreased exports of pulp and paper, pulp production, at 1,010 thousand tons, was only 70 thousand tons less than in 1951. Consequently, stocks were high at the end of the year and, though

some mills were closed, others kept their workers employed by turning them from production to maintenance work.

United Kingdom

The steady rise in United Kingdom paper production, which had taken place since the war, continued in the early months of 1952. In March, however, there was a sudden fall in output of packaging paper and board, and this was followed in succeeding months by a steady decline in output of all grades of paper and board. By the third quarter, the rate of paper production was the lowest recorded since 1948 and that of board the lowest since 1947. Import restrictions in U.K. export markets led to falling exports, but the main cause of the serious recession in the paper trade was a falling-off of activity in the many industries, both home and overseas, which use paper and its products.

From the beginning of the year pulp prices fell sharply as a result of the import price ceilings imposed by Britain, Europe's biggest paper-maker and pulp buyer, and other countries. With stocks high and consumption falling as a result of reduced paper production, there was no incentive to resume buying. The lower prices failed to act as a stimulus, buyers holding off in the expectation of further falls. Prices thus continued their downward swoop and not until the last quarter of the year, when some mills felt the need to replace stocks and when the demand for and production of paper and its products began to pick up, did prices begin to steady.

The trend of pulp, paper and paper products prices in the United Kingdom (see Diagram B) gives a fair picture of the events of the last three years in Europe. Pulp prices soared continuously from mid-1950 to July 1951 and made further slight gains in the second half of 1951, when they stood at about 3½ times their early 1950 level. From January to September 1952 they fell continuously and steeply, flattening out at the end of the year to a level about 1½ times that of early 1950. Paper and board prices followed the course of pulp prices with a short time lag. The rise was not as steep and the fall less abrupt. Similarly, paper and board product prices lagged behind the prices of paper and board, on the whole, though the price of cardboard boxes, undercut by a specially marked fall in demand, started to fall earlier.

So marked was the contraction in paper and board consumption that, although imports fell by over a third (from 960 to 646 thousand metric tons) and production by 14 percent (from 2,763 to 2,376 thousand tons), mill stocks nevertheless rose in the course of the year by 120 thousand tons.

TABLE 10. — U. K., PULP AND PAPER DATA, 1950-52
(in thousand metric tons)

Year	Paper and board			Consumption of paper-making materials other than wood pulp (paper equivalent)	Wood pulp		
	Production	Stocks	Imports		Consumption	Stocks	Imports
1950	2 656	157	681	1 134	1 559	281	1 456
1951	2 763	179	990	1 318	1 549	398	1 699
1952	2 376	299	646	1 083	1 392	446	1 460

It is interesting to note that, while paper production fell by 390 thousand tons or 14 percent, wood pulp consumption fell only by 160 thousand tons, or 10 percent. The effect of cheaper wood pulp was to reduce the use of other fibrous materials by 230 thousand tons paper equivalent. It is true that the biggest contraction in paper output took place in those grades for which other materials are most used. Nevertheless, price was a factor, notably in the case of esparto. Esparto prices did not, in fact, follow the course of pulp prices. Taking advantage of the 1951 boom, the Tunisian administration added to the existing 15 percent export tax a surtax of 30 percent on the f.o.b. price. In consequence, esparto imports into the United Kingdom, the principal buyer from Tunisia and Algeria, fell from 395 thousand metric tons in 1951 to 244 thousand metric tons in 1952; and though British buyers at the beginning of this year received the necessary allocations to cover their January-June requirements, they showed themselves completely disinterested in North African esparto at the prices ruling.

Imports of wood pulp fell by nearly 240 thousand tons compared with 1952. The Scandinavian countries bore the brunt of Britain's reduced import program, receipts of pulp falling by 230 thousand tons and of paper and board by 225 thousand tons. At the same time, imports from Canada increased; for the most part these represented deliveries against contracts entered into the previous year.

Towards the end of the year industrial production began to improve, demand for paper products strengthened and activity in the paper trade increased. Early in 1953 the fixing of paper prices for several months ahead invited buyers to shed their reserve. There was an increasing impression in the paper trade that the revival would last.

France

Events in France followed much the same course as in the United Kingdom. Total production of paper and board fell from 1,561 thousand tons in 1951 to 1,230 thousand tons in 1952. Newsprint suffered least, falling by only 11 percent as against 22 percent for packing paper and 29 percent for board. By December, 1952, the average price of paper had fallen exactly one-third below its peak level in December 1951. Wood pulp production fell from 550 to 519 thousand tons. Imports of both pulp and paper were well down compared with the previous year, and no great increase in imports is expected in 1953 because of France's current exchange difficulties.

As in Britain, the market quickened at the end of the year, but French buyers took longer to persuade themselves that prices had stopped falling and not until March did confidence begin to grow.

Western Germany

Industrial production in Western Germany continued to advance during 1952, though at a slower rate than in preceding years. The general index of production, which for 1951 averaged 218 (1948 = 100), registered 220, 228, 228 and 257 in the four successive quarters of 1952. In spite of this continued rise in the level of economic activity, Western Germany also experienced a recession

in the pulp and paper trade. For Western Germany is by no means insulated from the European market and the trend of prices. Though net imports account for only one-fifth of her total pulp supplies, she is heavily dependent on pulpwood imports.

Rising prices in 1952 led to a slackening in demand and a tendency on the part of consumers to reduce stocks. Though imports of paper and board rose 50 thousand tons above the previous year's level, imports were down from 91 to 28 thousand tons. Newsprint production rose by 11 thousand tons but output of other categories of paper and board fell by 121 thousand tons. The net fall in paper and board output, 6 percent, was much less than in other Western European countries.

Table 11. – West German Imports and Exports, 1951-52
(in thousand metric tons)

Year	Imports		Exports	
	Pulp	Paper and board	Pulp	Paper and board
1951	343	119	94	91
1952	265	169	45	28

Pulp imports were down by about 80 thousand tons and pulp production, at 890 thousand tons, 9 percent below the 1951 level. Most of the reduction was recorded in chemical pulp, mechanical pulp output for the year being only 16 thousand tons less than in 1951.

Table 12. – West German Pulp and Paper Production, 1950–52
(in thousand metric tons)

	Paper and board			Wood pulp		
	Newsprint	Other paper and board	Total	Mechanical	Chemical	Total
1950	170	1 395	1 565	355	498	853
1951	162	1 643	1 805	414	568	982
1952	173	1 522	1 695	398	492	890
Percentage change, 1951 to 1952	+7	—7	—6	—4	—13	—9

The market recovered earlier in Western Germany than in other European countries. Though output of both pulp and paper was low in the third quarter of the year a marked improvement began in October, and in January 1953 the output of paper and of chemical pulp exceeded even the 1951 average.

Austria

Paper and board output in 1952 totalled 325 thousand tons, a fall of only 4 percent from the 1951 level. The grade most affected was wrapping paper, for which a fall of 14 percent was registered. Thus domestic pulp needs were not seriously reduced and, since exports fell by a mere 10 thousand tons, the reduction in pulp output was less serious than in the northern exporting countries. The total for the year, 356 thousand tons, was but 6 percent below that of 1951.

Italy

In Italy, production of paper and board was well maintained in spite of a sharp fall in exports, and output for the first ten months of 1952 was slightly above that in the corresponding period of 1951. Imports of pulp for the year totalled 198 thousand tons, 32 thousand tons less than in the preceding year. Production of all categories of wood pulp is provisionally estimated at 290 thousand tons as against 313 in 1951. One effect of the difficult conditions in the international market was to reduce Italy's favourable balance of trade in paper and its products, which in 1951 represented a substantial offset to the country's heavy import bill for wood pulp, from 10.7 to 1.1 thousand million lire.

Possible Trends

Reappearance of short-time working and a closing-down of plants characterized 1952. Some pulp and paper investment programs threatened to be slowed down. For the first time for several years the supply of newsprint was adequate to meet effective demand.

On the face of things these events seem to suggest that the pulp and paper shortage, which has been with us for several years and was regarded as likely to last well into the future, was a passing one and that the apprehensions of 1949-51 were unjustified. This, however, would be taking only a short-term view. It would be more accurate to regard the phenomena of 1952 as the inevitable harvest of the Korean war inflation and of the slowing down of industrial progress.

Recent output figures suggest that the check in economic progress was only temporary. Moreover, there are many factors making for a steady long-term rise in the demand for pulp and paper — increasing industrialization in the less developed countries and the rapid liquidation of illiteracy, to name only two. Per capita consumption in parts of Europe is still below that of pre-war. All observers agree that consumption will continue to increase in the U.S.A., though at a rate a good deal less spectacular than that of recent years. And if optimism is a good deal more restrained in Scandinavia than across the Atlantic, this can be accounted for by the fact that the three northern countries, dependent on pulp and paper exports and less well insulated from fluctuations in world demand, are pardonably hesitant, in the light of recent events, in deriving overmuch comfort from favorable omens.

Moreover, one great uncertainty remains. Should the recent signs of a political *détente* multiply and bring concrete results, will the transition from war-preparedness to tacit truce have serious repercussions on the general level of economic activity? The pulp and paper trade, as we have seen, is very sensitive to changes in the economic climate. The theory that " peace is always bullish " is not universally shared. The New York stock market at the beginning of May had not yet recovered from its end-March " peace scare " downward plunge.

True, it is that apprehension centers on the prospect of uncomfortable short-run adjustments rather than on the long-run effects of a real *détente*. And since economic experts and share operators continue to differ loudly, a small element of doubt inevitably intrudes into the prospects for the pulp and paper market.

Sawn Softwood

World Market since 1951

The year 1951 held the postwar record for world trade in sawn softwood: on the other hand, 1952 was characterized by a general decline in the market, which, in Europe, reached almost to the point of stagnation during the first six months. Trends varied, however, in different parts of the world, particularly in North America compared with Europe, Australia and Africa.

In North America demand declined rather steeply during 1951, notably in the United States, whereas in Europe this was a boom period with trade figures approaching pre-war levels. In regions such as Australia and North and South Africa, which largely depend on imported supplies, a remarkable boom was experienced in sawn softwood imports during that year. In 1952, however, these trends were reversed. In North America, there was a marked increase in demand, particularly during the latter half of the year, and consequently also a larger output of sawn softwood. In Europe and the other regions demand fell generally, and output in the exporting countries dropped.

The great demand for sawn softwood in the main importing countries during 1951 had been created chiefly by fears of a shortage caused by the Korean war, which led to the accumulation of stocks and at the same time to an unprecedented rise in prices. Consumers' resistance to these excessive prices, already apparent around the summer of 1951, had resulted in almost complete stagnation on export markets towards the end of that year, and this situation persisted until the summer of 1952. By that time export prices had fallen sharply, and fresh interest was being shown in business. Even so, in Europe, Australia and other regions during the latter half of 1952 export demand did not pick up to the extent that might have been expected. In general, consumption had shown a downward trend since the summer of 1951, and, with the arrival of earlier contracted goods, stocks were kept at a fairly high level.

The excessive 1951 prices of sawn softwood led to the growing use of substitute materials, particularly in those countries largely dependent on imports, a trend which it was difficult to reverse even when prices of sawnwood fell. Moreover, the reduced pace of Europe's industrial growth, which in some cases even took the form of a slight recession, added weight to the fall in demand.

The development of demand for sawn softwood seems in general to have followed that of consumer goods, although, notably in Europe, fluctuations, both in demand and prices, were much more violent with regard to timber than to other materials and goods. Trends in 1951 and 1952, as well as in the early part of 1953, also indicate that the European market is much more sensitive to variations in demand than other markets, and that changes affecting relatively small quantities may lead to noticeable price fluctuations on the market as a whole (see Prices).

Demand in the extra-European importing regions more or less shadowed the changes in European demand, while such fluctuations in North America, a region self-sufficient in sawn softwood, had no major effect on demand in other regions.

Variations in the international, and especially the extra-regional, sawn softwood trade were due partly to the growing shortage of dollars in the sterling group (which seems to have forced most countries to curtail their purchases from North America during 1952) and partly to the fairly satisfactory stock position in those countries. At the same time, general difficulties concerning the balance of payments in many importing countries led them to reduce their imports from other sources.

These then were the events contributing to the substantial fall in the volume of international sawn softwood trade in 1952, and leading to a decline in the world output of sawn softwood during that year, in comparison with both 1950 and 1951. World trade in sawn softwood, which had reached post-war record figures in 1951, fell rather sharply in 1952 mainly because of a decline in the volume of European exports and imports (Table 1). In 1950, world output (excluding the U.S.S.R., Eastern Germany and China) was about 31,290,000 standards; in 1951 it fell to some 31,100,000 standards; and in 1952 it was estimated to be around 30,610,000 standards. This steady, though relatively small, decline was primarily caused by the heavy drop (of some 80,000 standards) in European output which was, however, partly offset by the rise in U.S. production.

North America

United States of America

North America occupies a predominant position with regard to world supplies of sawn softwood, with a share of recorded world production and consumption equal to about 65 percent. Thus even relatively small fluctuations on the North American sawn softwood market may have determining effects on world consumption and output as a whole, without, however, affecting world trade.

In 1951, the index of sawn softwood demand had fallen sharply from its exceptionally high level of 1950, but rose again in 1952, notably during the latter half of the year. As the course of the North American market is almost entirely determined by demand in the United States, the fall in United States demand in 1951 caused a decline in the total North American output of sawn softwood in that year. The rise in Canadian output from 3,436,000 standards in 1950 to 3,687,000 in 1951 was insufficient to offset the decline in United States production, which fell from 15,470,000 standards in 1950 to 14,681,000 in 1951. In 1952, however, the increased demand and consequent rise in production

Table 1. — Production, Export and Imports of Sawn Softwood

(in thousand standards)

	Production		Exports		Imports	
	1951	1952	1951	1952	1951	1952
Europe	(b) 8 600	(b) 7 800	2 860	2 210	2 990	2 540
of which:						
Austria	694	629	516	522	*	—
Belgium-Luxembourg	59	54	2	1	118	106
Czechoslovakia			(c) 26	(c) 47		
Denmark	60	60	*	*	163	124
Finland	1 055	750	838	592	—	
France	749	685	186	70	52	84
Germany, Western	1 598	1 380	24	2	172	396
Greece	15	15	—	—	60	47
Ireland	4	2	*	*	72	47
Italy	217	186	8	2	198	230
Netherlands	28	14	1	2	378	274
Norway	310	400	26	8	30	31
Poland			(c) 18	(c) 24	72	
Sweden	1 300	1 070	908	686	16	20
Switzerland	173	201	7	1	19	13
United Kingdom	65	56	*	*	1 640	1 031
U.S.S.R.			(c) 133	(c) 126	(d) 62	(d) 123
Yugoslavia	363	345	139	104	—	
North and Central America	18 570	18 970	2 240	2 020	1 210	1 230
of which:						
Canada	3 687	3 582	1 799	1 726	39	47
United States	14 681	15 186	413	276	1 143	1 153
South America	820	(800)	240	(190)	210	(170)
of which:						
Argentina	..	..	..	..	190	(150)
Brazil	745	(700)	230	(175)	—	
Chile	38	(40)	13	(10)	2	*
Africa	190	(200)	10	(10)	370	(250)
of which:						
Algeria	10	(10)	*	*	47	(40)
Egypt	..	..	—	—	132	60
Union of South Africa	(135)	(140)	(2)	(2)	125	(85)
Asia	2 580	(2 500)	(a)	(a)	90	(100)
of which:						
Israel	..	..	—	—	47	(30)
Japan	2 500	(2 400)	..	..	6	..
Turkey	24	32	3	1	11	36
Pacific Area	340	(340)	10	(10)		(150)
of which:						
Australia	65	(60)	*	*	202	(130)
New Zealand	270	(270)	9	(7)	7	(7)
Estimated total	31 100	30 610	5 360	4 440	5 080	4 440

(a) Reporting countries only.
(b) Includes estimates for countries of Eastern Europe. Excludes Eastern Germany and U.S.S.R.
(c) Exports to countries of Western Europe only. Figures taken from importing countries.
(d) Imports from countries of Western Europe only. Figures taken from exporting countries.

in the United States were sufficient to bring about a rise in the total output of North America, despite a slight fall in Canadian production.

Building activity in the United States had been very great in 1950, construction of as many as 1,396,000 non-farm dwellings being started, and this was a primary factor affecting the demand for sawn softwood. In 1951, the rearmament program had led to restrictions being imposed on private building, causing a gradual fall, to 1,091,300 for the whole year, in the number of dwellings which were started. Industrial and public construction, however, continued at a high rate even in 1951 but, since they relied chiefly on other materials, did not generally have any effect on the consumption of sawn softwood. In 1952, the relaxation of some restrictions caused a certain rise in the number of non-farm dwellings under construction, particularly towards the end of the year, by which time 1,131,400 units had been started. At the same time, the upward trend of industrial and public construction continued, and 1952 was generally considered the record year for total value of construction (estimated at some 32.3 billion dollars). This increased building activity also brought about a growing demand for sawnwood from furniture industries. In consequence, there was a noticeable rise in the consumption of sawn softwood, from 15.2 million standards in 1951 to some 15.9 million in 1952.

Imports by the United States, chiefly from Canada, remained practically unchanged during 1952, amounting to 1,153,000 standards as against 1,143,000 in 1951. Exports, on the other hand, which had risen to some 413,200 standards in 1951 as a result of declining demand on the home market and attractive prices paid by overseas countries, fell to about 272,000 standards.

Sawn softwood prices in the United States had on the whole changed little during the period 1950 to 1952, in striking contrast to the violent price fluctuations in Europe and other parts of the world (Table 2).

Canada

With regard to Canada, in 1951 when United States demand had been weaker, the sawmilling industries had found an outlet for their export production in Europe and other overseas markets, where demand was heavy and attractive prices could be obtained. This, together with a rather strong domestic demand for building purposes, had led to an increase in Canadian output of sawn softwood, as well as in exports.

In 1952, domestic demand fell off somewhat, and an overall decline in sawnwood consumption of some 5 percent was registered. This was the result of a decline in building activity, together with a noticeable drop in purchases by the Commonwealth and other overseas countries, for which the dollar shortage was chiefly blamed. Sawmills were therefore forced to reduce their output, and total consumption of sawnwood of all categories, which in 1951 had been around 1,650,000 standards, fell to some 1,570,000 in 1952. The increased United States demand was only felt towards the end of the year, and it was not sufficient to raise Canadian exports to the United States much above the level of 1951; in fact, they remained almost the same, namely, 1,179,000 standards in 1952 as against 1,154,000 in 1951. Exports to other countries, however, dropped from 645,000 in 1951 to 547,000 standards in 1952, mainly due to a fall in exports to Commonwealth countries other than the United Kingdom. Exports to the latter country fell only slightly.

Europe

The extraordinary boom on the European sawn softwood market had continued from the last months of 1950 to the autumn of 1951. Due primarily to heavy purchasing by the United Kingdom towards the end of 1950, the boom had gathered strength since other importing countries, both in Europe and overseas, fearing a depletion of sawnwood availabilities in the exporting countries, a general shortage of sawnwood caused by the Korean war and above all a rise in prices, joined in the purchasing. There was no depletion of availability in the exporting countries, a proof of their amazing flexibility in production. European production thus rose markedly in 1951, and reached (excluding the U.S.S.R. and Eastern Germany) 8,600,000 standards compared with 8,400,000 in 1950.

Table 2. – Index of Sawn Softwood Prices
(January 1950 = 100)

Country	Jan.	Mar.	June	Sept.	Dec.	Mar.	June	Sept.	Dec.	Mar.	June	Sept.	Dec.	Explanation
	1950					1951				1952				
Canada	100	101	110	113	116	134	134	134	133	130	124	124	124	Wholesale price index for sawn fir.
Belgium	100	101	104	109	145	169	176	187	196	185	128	142	155	Average price c.i.f. for Swedish and Finnish sawn softwood.
	100	104	98	100	114	125	132	135	148	146	129	113	128	Average—wholesale price from importer to wholesaler.
France	100	100	103	110	120	183	269	282	316	329	308	267	267	Unedged spruce boards, 26 mm. thick, for construction.

Despite the large quantities of sawn softwood on the European market in 1951, European consumption did not increase, and in some countries it even showed signs of decline, chiefly the effect of the great rise in import prices. In fact, increases in sawn softwood wholesale prices in most of the European countries were relatively much less marked than those of import prices. Consumers' growing resistance to high prices had already made itself felt in the summer of 1951, and by the winter import prices of sawn softwood shipped during the second half of the year were, in general, considerably above the prevailing (and obtainable) wholesale prices. In the face of this strong consumers' resistance and with heavy stocks of imported sawn softwood, importers and retail merchants were experiencing growing financial difficulties.

On the declaration of the United Kingdom, towards the end of 1951, that it would substantially reduce its imports in 1952, the importers of the other European countries considered that the moment had come to join in a common stand against the high export prices. The result was that almost all the buyers went on strike during the last months of 1951 and the early months of 1952, while exporting countries made efforts to maintain the level of prices, because the high cost of sawlogs at the end of 1951 had made it difficult to reduce them. The first five months of 1952 were thus characterized by general stagnation on the market, and by a price war between exporters and importers. However, growing financial difficulties of sawmills in the exporting countries finally led them to yield, and a heavy drop of some 30 percent in export prices occurred in May.

Immediate demand responded less favorably to this fall in prices than had been anticipated. Most countries still had large and expensive stocks of sawn softwood, and felt no immediate need to replenish. On the contrary, importers preferred to dispose of their existing stocks to the greatest possible extent before contracting for new supplies. Furthermore, the trend in consumption in most countries had weakened since the autumn of 1951, primarily due to high prices, and the volume of wholesale business in the importing countries had been steadily falling. Again, the high prices of sawn softwood had greatly strengthened the position of substitute materials between the summers of 1951 and 1952, and it was proving difficult to bring about a reversal of this trend, since consumers did not seem to show confidence in the future development of prices.

Towards the middle of the summer of 1952, however, importers started placing contracts on a larger scale in the exporting countries, in order to replenish their stocks for the winter of 1952/53. Prices were thus stabilized at a level about 30 percent below the previous top prices, and towards the end of the summer they even showed some signs of strengthening. In September, a sudden heavy demand by the United Kingdom drove prices up again. In November, when the British demand weakened, the market calmed down and prices stabilized at a level some 15 percent above the low prices of the summer of 1952, and some 20 percent below the 1951 top prices. Importers in the Continental countries remained rather inactive until the end of the year in negotiating purchases for delivery in 1953. They only entered the market seriously at the beginning of 1953, at which time British buyers also showed increased interest in contracting for 1953.

The volume of business concluded by the end of April 1953 was substantially larger than that of the corresponding period in 1952, when practically none had been contracted, but it was still distinctly less than that of the buying boom of 1951/52. The Northern European exporting countries were reported to have sold slightly more than 90 percent of their total estimated 1953 export availabilities by the end of April, while the importing countries had covered some 60-80 percent of their normal import requirements, with the exception of the United Kingdom which was estimated to have purchased almost its total requirements. Purchases by overseas countries from Europe, which fell sharply in 1952, remained at an unusually low level and very little business had been done by the end of April, 1953, for shipment the same year.

As a result of the fall on the European sawn softwood market in 1952, European output (excluding that of the U.S.S.R. and Eastern Germany) dropped noticeably, being only 7,800,000 standards, which was chiefly due to the decline in the production of Sweden and Finland. European trade in sawn softwood also fell markedly (by some 20 percent in value). Exports by European countries were only 2,210,000 standards, as against 2,860,000 in 1951 and 2,620,000 in 1950. There was a sharp drop in European exports to overseas markets—218,000 standards in 1952 as against 395,000 in 1951 and 375,000 in 1950. On the other hand, imports of sawn softwood by European countries fell from 2,990,000 standards in 1951 to 2,540,000 in 1952, chiefly owing to a decline in imports by the United Kingdom. Imports for 1950 had been 2,270,000 standards. With regard to European imports from overseas, mainly from North America, these totalled 569,000 standards in 1952 (a large part of which, however, had been purchased already in 1950), compared with 608,000 in 1951 and 211,000 in 1950. The relatively greater decrease in exports (23 percent compared with 15 percent imports) was a result of the fall in European exports to overseas markets, the fall in imports from overseas being small.

Trade between western and eastern European countries expanded in both directions. Exports by eastern to western Europe rose from 177,000 standards in 1951 to 199,000 in 1952, and imports by the eastern European countries from western Europe, chiefly by the U.S.S.R. from Finland, rose from 63,000 standards in 1951 to 130,000 in 1952.

Exporting Countries

Northern Europe

The fluctuations on the sawn softwood market between 1950 and 1953 primarily affected the timber industries in the two principal northern exporting countries, Sweden and Finland. Sawn softwood and other forest products being their main exports, the foreign trade of these two countries had been booming in 1951, both in value and volume. The output of sawn softwood in Sweden and Finland together had risen during 1951 to 2,355,000 standards, as against 2,015,000 in 1950, and exports had reached 1,746,000 standards as against 1,462,000 in 1950. As demand slackened at the end of 1951, these countries decided to curtail their production in order to strengthen their position in

the face of growing buyers' resistance to high prices.

The main reason for these efforts to maintain the level of prices had been the extraordinary rise in the prices of sawlogs during the autumn of 1951. The cost of sawlogs for one standard of sawnwood was in some cases reported to have reached the equivalent of the prevailing prices for sawnwood. Buyers' resistance, however, had for some time been aggravated by the introduction of export charges on sawn softwood, which was considered by importing countries to have increased prices disproportionately. These export charges had already been partially introduced into Sweden in June 1945 in the shape of payments to price equalization funds, and had increased in 1951, the basic prices being those of the last quarter of 1950. They were intended to prevent any unfavorable effect of export price rises on the home market, and on the national economy in general. In Finland, the export charges were introduced rather late, in October 1951, the basic prices being those of the second quarter of 1951.

As buyers' resistance continued, both Sweden and Finland were forced to abrogate these charges, but the price fall in May 1952 was not simply the result of the lifting of export duties, and serious difficulties were anticipated by the sawmills. Despite these fears, the situation turned out to be less unsatisfactory than

TABLE 3. — SWEDISH WHOLESALE SAWN SOFTWOOD PRICES
(Kroner per standard f.o.b., Härnösand district)

	March	June	Sept.	Dec.
2½ in. × 7 in. redwood battens u/s:				
1950	700	750	775	1 050
1951	1 180	1 235	1 260	1 325
1952	1 285	930	985	1 070
1953	1 095	...	...	...

had been expected. In Sweden, where export duties had been levied well before the record year of 1951, the sawmills found themselves in a situation corresponding more or less to that which existed before the boom. The much-criticized duties had prevented any disproportionate rises in production costs, and sawmills had no unsurmountable difficulty in adapting their sales prices to the new level of export prices. In Finland, however, the situation at first appeared to be more dangerous. The late introduction of export duties had not prevented the extraordinary rise of production costs, and sawmills found it extremely difficult to keep in line with the new development. At the beginning of 1952, when the rest of the market was almost dead, the large sales to the U.S.S.R., at amounts corresponding to previous top prices, considerably helped sawmills to surmount their immediate difficulties. To some extent these sales also compensated for the low prices obtained elsewhere in the summer of that year. By the latter half of 1952 most of the sawmills in the northern countries had been able to adjust their raw material prices to those obtainable for sawn softwood on foreign markets, and they were thus able to offer their goods at acceptable prices. The decline on the market in 1952 nevertheless led to a heavy fall in output, as well as reduced exports of sawn softwood, which totalled 1,820,000 and 1,278,000 standards respectively.

Exports to overseas countries fell markedly, being only 109,000 standards in 1952 as against 227,000 in 1951 and 222,000 in 1950. By the end of April both Sweden and Finland were estimated to have sold most of their sawnwood available for export in 1952.

Austria

Austria, the most important exporter of sawn softwood in Central Europe, had also been affected by the boom of 1950/51 and had greatly increased output and exports in 1951. It faced similar difficulties to the price equalization charges for export of the northern countries and the high level of prices of sawlogs after the fall in the value of sawnwood. In 1952, however, when the European market generally was in an unsatisfactory condition, Austrian sawmills succeeded in increasing their sales to Italy and, particularly, to Western Germany, where import requirements in that year were considerably larger than in the previous postwar years. Austria's success on these markets was mainly due to its sawn softwood prices being low in relation to those of the northern European countries, which had a less favorable position. Consequently, Austrian exports of sawn softwood rose in 1952 to 522,000 standards as against 516,000 in 1951, and 483,000 in 1950. The production of sawn softwood, on the other hand, fell from 694,000 standards in 1951 to 629,000 in 1952, although it was higher than in 1950 (568,000 standards). Large unsold stocks had accumulated towards the end of 1951 and the beginning of 1952, with a consequent slowing-down of activity in sawmills during the first months of 1952, and this resulted in the decline in the output of sawn softwood.

With regard to sales for 1953, the dominant position of Austria in relation to Western Germany and Italy during 1952 seems to remain unchallenged: the other main exporting countries had placed only minor quantities by the end of April 1953, whereas Austria's contracts were for substantial amounts.

Yugoslavia

Although the production and export of Yugoslavian sawn softwood also declined, they were less affected by the fall on the market in 1952 than those of the Northern European countries. Exports were 104,000 standards in 1952 as against 139,000 in 1951 and 158,000 in 1950. Output fell from 503,000 standards in 1950 and 363,000 in 1951 to 345,000 in 1952. Factors other than reduced foreign demand contributed largely to this continuous decline, such as efforts made towards a gradual restriction of the heavy fellings of the post-war period. Domestic consumption remained fairly stable, and thus export availabilities were automatically being reduced. However, despite the generally falling market of 1952, Yugoslavia succeeded in increasing its exports to Western Germany and Italy; those to the United Kingdom on the other hand fell sharply.

United Kingdom

As during the past three years the fluctuations on the European sawn softwood market have been primarily the result of the purchasing policy of this country, changes in United Kingdom demand are particularly interesting.

Purchases by the United Kingdom during the period 1950 to 1952 have in fact varied yearly between 600,000 and 700,000 standards. Such variations in demand, when the European output of sawn softwood was normally considered to be fairly stable, were bound to create a feeling of instability on the market as a whole. The United Kingdom had greatly restricted its total purchases for 1950, particularly from the northern European countries, which are traditionally its main suppliers, thus forcing them to seek other markets. But in 1951 the United Kingdom increased its total purchases, chiefly from the northern European countries and Canada, a fact which was bound to affect the whole European market severely. Consequently, purchases from Canada by other European countries were made largely on their dollar resources, and, since these remained weak, no major increase in imports from Canada could be foreseen. As a result, the big increase in United Kingdom demand, coupled with rising post-Korean demand from other countries, weighed almost entirely on European export availabilities, and led to the 1951 boom.

With regard to purchases for 1952, the situation was again reversed. As has been seen, the declaration by the United Kingdom to curtail its imports for that year was the main cause of the falling market. As this country already had large unfulfilled contracts with Canada, and since demand was also declining in most of the other European importing countries, the European export market was even more affected. Although in May prices had fallen to a level generally considered to be reasonable by the importing countries, in September (a period when there was general uncertainty as to further quotas) the release of 500,000 standards for free buying brought about a new increase in prices. Had buying been spread over a longer period, its effects might have been less significant; but purchasing was done within a short period, an outcome perhaps of the fear of being left without any sawnwood. This argument is proved by the fact that when the authorities announced further quotas, up to at least one million standards, to be released later, the market calmed down immediately, and purchasing for 1952 progressed at a much slower rate during the last months of 1952.

At the turn of the year the sawn softwood import trade was completely liberated, and importers were free to purchase whatever amounts they considered they would be able to sell or store in view of consumption control and their limited financial resources. But importers grew more cautious in their contracting, and there was a decline in activity. By the end of April, 1953, almost the whole of the United Kingdom's import requirements for the year — some 1,100,000-1,200,000 standards — were reported to have been covered.

Western Germany

Western Germany, Europe's largest producer and consumer of sawn softwood, is self-sufficient up to 85-90 percent of its total requirements although, in an effort to avoid the over-exploitation of its forests, production has been reduced gradually from the high level of the immediate post-war years. Its domestic requirements, on the other hand, have increased as the result of a big rise in general industrial production and construction, with a consequent gradual expansion of import requirements.

This development was illustrated by the rise in imports of sawn softwood from 1950 to 1952, during which period they more than doubled, reaching 396,000 standards in 1952 as against 172,000 in 1951 and 153,000 in 1950. Output during the same period had fallen from 1,679,000 standards in 1950 and 1,598,000 in 1951 to 1,380,000 in 1952. High export prices, particularly in the northern European countries, led importers to place their purchases for 1952 chiefly in Austria, where both prices and transport costs were lower.

Purchases effected by Western Germany for 1953 seem to indicate that imports this year will be more or less at the 1952 level, and that Austria will once more become the largest individual supplier of sawn softwood to Western Germany. The position of the northern European countries continues to be rather weak, chiefly because of the higher prices asked by them.

Italy

This country normally covers about one-half of its total requirements by domestic production, in which there were no marked changes during 1950-1952. Imports had fallen from 218,000 standards in 1950 to 198,000 in 1951, partly because of the high prices and partly because of slackening in demand due to general economic factors. In spite of this, imports rose to 236,000 standards in 1952, owing on the one hand to the necessity of replenishing stocks, and on the other to ample quantities of Austrian sawn softwood being available at acceptable prices for delivery in 1952. The general improvement in economic conditions towards the end of 1952 also led to a somewhat higher activity in the Italian timber trade. Purchasing for 1953 was therefore started under fairly favorable conditions.

Other countries

The most important group of importing countries in Europe is composed of Belgium, Denmark and the Netherlands, which depend almost entirely on imported supplies of sawn softwood. The total sawn softwood output of this group has not changed greatly during the period 1950-1952, being 139,000 standards in 1950, 139,000 in 1951 and 125,000 in 1952. Imports, on the other hand, have shown a marked downward trend, viz., 818,000 standards in 1950 (the postwar record year), 659,000 in 1951 and only 504,000 in 1952.

There were several reasons for this development: one, affecting the 1950 imports, was the decline in British purchases from Europe, which led the main European exporting countries (notably the northern ones) to try to increase their exports to this group.

As stocks in Belgium, Denmark and the Netherlands had reached a somewhat low level by the end of 1949, their purchases were aimed both at covering current requirements and at increasing the stock level. Consumption, however, remained rather lower than had been envisaged by the importers, and by the end of 1950 they were left with substantial unsold stocks. The lower volume of imports in 1951 was a direct result of these high stocks, and purchases were made more or less to cover the current turnover. In the course of 1951 consumers' resistance reduced demand still further, and importers' and wholesale stocks at the end of 1951 were almost equal to those of a year before. Large and expensive stocks during a period of generally falling demand naturally led to financial difficulties, and purchasing for 1952 on a larger scale was started cautiously and late towards, and particularly during, the summer of that year.

The effects of the 1951 rise in sawn softwood prices were still being felt quite severely even during the first half of 1952, and consumption continued its downward trend. It picked up but slightly after the summer, and therefore the stocks in these countries at the end of that year remained rather close to the level of the end of 1951. Importers have been rendered rather cautious by these developments of 1950-1952, and purchases for 1953 were only commenced about the beginning of the year, and at a slow rate. By the end of April this group of countries had covered some 70 to 80 percent of their previously estimated total import requirements for 1953.

Importing and Exporting Countries

France

This country, being practically self-supporting with regard to sawn softwood, has normally both exported and imported. Imports have been limited to special specifications and qualities, chiefly from Northern Europe and Austria, while exports of certain categories have a traditional market in the United Kingdom.

Output has to some extent been influenced by developments on the international sawn softwood market, although these have chiefly affected internal price levels. The output of sawn softwood in 1950 was 620,000 standards; it rose to 749,000 standards in 1951 and declined again in 1952 to 685,000 standards. Imports remained at about the same level during 1950 and 1951 being 59,000 standards and 52,000 standards respectively, but rose to 84,000 standards in 1952. Exports, on the other hand, fluctuated more with 130,000 standards in 1950, 186,000 in 1951 and 70,000 in 1952. The 1951 rise in exports was caused chiefly by the high prices paid abroad for sawn softwood, which at the same time increased domestic price levels. As these excessive exports threatened to endanger the country's supply situation and to drive domestic prices up to an unreasonable level, the government was forced to impose restrictions in the autumn, limiting exports almost entirely to quantities included in the trade agreements of 1951.

The increase in imports and decline in exports in 1952 were thus a direct result of developments during 1951. Greater imports were needed to cover the country's requirements, and export restrictions, together with falling prices abroad, automatically reduced the volume of export. For 1953, the estimated French import requirements show some increase over those for 1952. As a result of the lifting in 1952 of some of the restrictions introduced, export are also expected to increase slightly.

Eastern European Countries and the U.S.S.R.

As mentioned in the section on Europe above, exports by this country group to Western Europe, as well as imports therefrom, rose in 1952. The prospects for 1953 indicate further rises in both directions. Sales by these countries to the United Kingdom, for example, had already reached about twice the amount of total 1952 exports by the end of April 1953. Contracts negotiated with other Western European countries are also believed to be at more or less the 1952 level. Purchases by the eastern countries, notably the U.S.S.R., from Finland, seem equally to indicate a rise in their imports from Western Europe. To sales of sawn softwood should be added sales of pre-fabricated timber houses from Finland to the Eastern European countries, and particularly to the U.S.S.R., which are estimated at approximately 100,000 standards of sawnwood.

Brief Survey of Other Areas

Latin America

The boom of 1951 also had its effect on the Latin American sawn softwood market, because the high prices paid for sawnwood in Europe had bolstered up exports from Latin America (in particular, Brazil) to Europe and to other overseas countries. At the same time, demand increased in the importing countries (notably Argentina) and inter-regional trade also rose somewhat. As a result, output rose from about 650,000 standards in 1950 to some 820,000 in 1951. In 1952, however, in the face of reduced demand for sawnwood on the main overseas markets, and of declining world prices, the Brazilian producers were threatened with a serious reduction in foreign business, with particular regard to extra-regional trade. They seem to have been unable to bring their prices into line with the prevailing world prices, and consequently the volume of exports showed a marked fall in 1952. This appears to have led to some reduction in Brazilian output and consequently in the total Latin American output of sawn softwood as well.

Africa

Africa is almost entirely a sawn softwood-importing region, which obtains its supplies regularly from North America, South America and Europe, imports from the latter being largest. Imports, already fairly high in 1950 at 340,000 standards, rose to 370,000 standards in the boom year in 1951. In 1952 they fell noticeably, being only 250,000 standards.

The largest individual importing country during 1950 and 1951 was Egypt, importing 133,000 standards and 132,000 standards respectively. In 1952 Egypt's imports dropped sharply to only 60,000 standards as the result of rather heavy over-buying in 1950 and

1951, which left the country with substantial stocks. The political events of 1952, coupled with serious financial and foreign currency difficulties, forced the country to curtail heavily its imports from all sources, in spite of the reduction in stocks during the course of the year. The outlook for 1953 indicates that there will be no major change in Egyptian imports of sawn softwood, unless the balance-of-payments situation and general financial position improve, depending on the cotton crop, Egypt's main product, and on overseas demand.

The other large single market for sawn softwood in Africa is that of the Union of South Africa. Imports by this country had reached a post-war high in 1951, with about 125,000 standards as against 105,000 standards in 1950. The unprecedented rise in prices in 1951 brought about consumers' resistance, and consumption apparently fell slightly towards the end of the year. Faced with an uncertain market importers were cautious in their purchasing, and contracted more or less for immediate needs and prompt delivery only, leaving the risk of expected price falls with the last-minute sellers. The usual contracting for arrivals 6 to 7 months ahead was consequently almost non-existent. To the uncertain market conditions during these early months of 1952 was added the Government's currency restriction policy. In fact, the currency quota system previously applied to dollars was extended to pounds sterling as well, with the aim of reducing imports, which fell in 1952 to 85,000 standards, the largest declines taking place in imports of sawn softwood from North America and Europe, both of which fell by some 20,000 standards. For 1953, importers expect the authorities to allow them to buy up to the 1952 quota.

Asia

Before World War II, Japan had been a big importer of timber, but by 1942 its imports had been practically eliminated, and were resumed only in 1948 and on a smaller scale. Japanese timber imports have, however, expanded rather slowly because of the lack of trade credits and of the rather high prices of imported timber. At the end of 1949, the Japanese authorities, alarmed by the growing timber shortage, issued an embargo on the export of most categories of wood, and notably of sawn softwood. This embargo was extended at the end of 1950, and in 1951 the main exports went to the United Nations forces in Korea.

The shortage of sawlogs in 1950 had led to the closing down of about 10,000 sawmills, or one-third of the active sawmills in Japan. Stocks of sawlogs had also dropped from 130 million cubic feet to some 70 million cubic feet (3.68 million to 1.98 million $m.^3$) in the course of the year. This latter figure is less than six weeks' operating supply. The total output of sawlogs in 1950 had been some 100 million cubic feet (2.83 million $m.^3$) short of demand.

The total production of sawn softwood (including boxboards) in Japan in 1950 had been 2,410,000 standards, and it rose only slightly in 1951 to 2,500,000 standards. At the beginning of 1952 the Japanese Government imposed cutting restrictions on softwood, which reduced stocks, and prices fell by some 30 percent from those of 1951. The market calmed down towards the end of 1952, both as regards domestic and imported sawn softwood, because of the economic stringency. Although there is a large potential demand for sawn softwood for housing, prices largely determine the extent to which housing needs can be met. Because of its substantial sawmilling capacity, emphasis seems to be laid more on Japanese imports of logs than on sawnwood. Prices of domestic sawn softwood for building purposes were slightly higher at the end of 1952 than the prevailing rate of imported sawn softwood. But, as mentioned above, the lack of foreign currencies is the principal restricting factor. Despite Japan's growing needs of sawn softwood, consumption seems to have moved slightly downwards, and is estimated to have been 2,450,000 standards in 1950, 2,440,000 in 1951 and around 2,400,000 in 1952.

All the other Asian countries for which data are available have limited trade in sawn softwood, although most of them are far from self-sufficient. Two of the most important countries in the Middle East, Turkey and Israel, together import some 50,000 to 60,000 standards yearly. Both have been facing growing difficulties with regard to balance of payments and foreign currency. In 1950 and 1951 Turkey, which normally covers about 60 to 70 percent of its needs by domestic production, had imported fairly small quantities, which were nevertheless reported to be adequate. But in 1952, Turkey succeeded in more than doubling its imports, chiefly from Austria. Its purchases for 1953 seem to be hampered by an increasing balance-of-payments deficit, and the shortage of most foreign currencies has led to purchases being limited to a great extent to countries which have direct clearing arrangements with Turkey. Israel, on the other hand, which depends practically entirely on imports, had increased them from 41,000 standards in 1950 to 47,000 in 1951. Financial difficulties caused a drop in its imports in 1952, estimated to be roughly some 30,000 standards.

Australia

The extraordinarily high volume of Australian imports in 1951 had led to a considerable accumulation of stocks. Therefore the quantity of sawnwood available for consumption was considerably in excess of that of 1950, and towards the end of 1951 supply exceeded demand for the first time since the end of the war. This increase resulted from efforts to overcome the general shortage which had existed in 1950, and it was assisted by some relaxation of tariffs and import controls.

Demand in 1951 was heavy and led to an increase in the Australian output of sawn softwood, which rose from 46,000 standards in 1950 to 65,000 standards in 1951, the highest figure ever recorded. Considerable improvement in weather conditions in the eastern states and in the availability of labour for sawmills in western Australia also contributed greatly to this increased production. However, during the latter half of 1951 the position was reversed, since the import licensing procedure was relaxed, and importers could purchase wherever they wanted more freely. This led to rather heavy over-buying from the most important regions of supply, and to a large influx of Baltic sawnwood. The difficulties of the trade in disposing of the large stocks accumulated by the end of 1951 were

Table 4. — United Kingdom Imports from Various Sources
(in pounds sterling per standard)

Country	1950		1951		1952		1953
	June	Dec.	June	Dec.	June	Dec.	Feb.
Canada	67.10.7.	62.14.7.	88.11.11.	93.15.11.	100.18.4.	96.18. 4.	78.15.10.
U.S.S.R.	48. 6.9.	58. 4.7.	58.16. 1.	104.14.10.	80. 7.0.	68. 7. 1.	81. 0. 0.
Finland	46. 3.3.	49. 0.6.	72. 1. 6.	86.11. 5.	92. 1.4.	74.10.11.	71. 7. 6.
Brazil	67.19.2.	72.13.0.	80. 1.10.	90.18. 8.	104. 0.7.	103. 3. 7.	97. 9.10.

further increased by an almost complete halt in building activity, caused by the credit restrictions policy of the government. Although building and price controls were relaxed in 1952 and there were signs of a recovery in the building industry, new purchases were much lower than in the previous year.

High prices and credit restrictions seem to have been the main factors hampering demand. Figures for Australian imports of sawn softwood in 1952 are not available, but they are estimated to have been about two-thirds of the volume and about half the value of those of 1951, because of the drop in prices. The apparent consumption of sawnwood, broadleaved and coniferous, seems to have risen in 1951, when it was estimated to be some 800,000 standards as against about 720,000 in 1950. In 1952, however, it showed some decline, owing to the difficulties mentioned above.

The prospects for 1953 are not easy to forecast, but there appears to be a possibility of a gradual recovery. Somewhat greater demand is indicated, and the ability to purchase foreign sawnwood, particularly from the dollar area, will depend on the foreign exchange situation.

Prices

As has been seen, the development of the sawn softwood market from 1950 to 1953 has been marked by extraordinary fluctuations in prices, which varied greatly according to region. The most noticeable contrasts have been found between North America on the one hand and Europe and other regions on the other. Prices in North America increased by some 30 to 35 percent, while ranging between as much as 200 percent upwards and 30 percent downwards in European prices. Generally speaking, the greatest fluctuations were experienced in European export and import prices, the latter being further accentuated by changes in freight rates, both European and ocean.

On the other hand, the wholesale prices of sawn softwood in most of the European importing countries rose less and their changes were smaller. Table 2 shows price changes in selected countries. The price index of sawn softwood in Belgium, a typical importing country, indicates the relatively smaller increase in wholesale and retail prices compared with that in import prices. The figures also reflect the determining effect of consumers' resistance on high prices in general.

The most striking aspect of price development is the rise of prices in France, which is completely out of line with the general run and where prices had apparently been at a fairly low level, but started rising when French exporters obtained attractive prices abroad during the general 1951 boom and consequently increased their exports. The disproportionate relations between prices on the French domestic market and those obtained from exports drove the former up to a level more or less corresponding to export prices, and had a most harmful effect on the French market. The market was disorganized, and at the same time high prices caused strong consumers' resistance and falling consumption.

In Austria, the level of domestic prices was maintained by the authorities below the prevailing export prices. When internal price restrictions were lifted, the rise was consequently greater than on the European market in general. Another interesting phenomenon is the relatively greater increase in the prices of lower-quality sawnwood, which at their highest are considered to be out of proportion, a typical aspect of a sellers' market.

The development of c.i.f. prices of sawn softwood on a cumulative basis is given in Table 4 below.

The period considered also presents some aspects of general interest. Despite its vast area, the North American market seems to have all the characteristics of a self-sufficient national market, with production following demand flexibly and without any major effects on prices. Europe, on the other hand, although much smaller in area, has all the complications of an international market, despite the remarkable ease with which European timber industries as a whole followed the changes in demand. The main reason for this seems to be the almost complete dependence of the European importing countries on supplies available in the chief exporting countries, and the resultant competition between the importing countries for these goods.

Developments after the heavy fall in export prices in May 1952 have been followed with growing anxiety by European timber trade circles. After the rise in the autumn of 1952, prices again reached the level at which consumers' resistance in the summer of 1951 had first been noticed. The course of events over the past three years indicates clearly the dependence of the consumption level on that of prices, and also a greater sensitivity of demand and consumption to price fluctuations than had been anticipated. The growing substitution of other materials for sawnwood during the period under review also shows the danger of further price increases to the timber trade in general, and to the future of sawn softwood in particular.

The Work of FAO

Forestry Education in Chile

The need, and opportunities, for men trained in forest practices have long been recognized, as early attempts at providing technicians and certain specific recommendations indicate. The Special Forestry Mission of 1943-44, made possible through co-operation between the U.S. Department of Agriculture and Chile's CORFO (Corporación de Fomento de la Producción), surveyed the forestry situation and presented its findings, known as the Haig Report after the leader of the project, I. T. Haig, who is now at FAO Headquarters, but officially entitled *The Forest Resources of Chile*. According to one of many recommendations, there is a fundamental need for a state-supported system of forest education to provide professional foresters and trained workers for the industries and government service. It was suggested that this training might well be at both university and vocational levels.

In the mid-forties, six young Chileans, graduates from the Agronomy School, gambled on a forestry education in the States, received master's degrees from the University of Michigan and returned home. They are currently all leaders in their profession. In 1944, a school, privately endowed, was started at Victoria and offered university-level training for forest engineers. Owing to the lack of finance, it was moved to Temuco in 1948, where some time earlier, the Government's Technical University had initiated a two-year program of vocational training in the skills of sawmilling and logging, but finally became inactive in 1951.

Forest research was recognized when, early in 1951, the Ministry of Lands and Colonization allotted 1,250 acres (506 ha.) of fiscal lands within the Llancacura Forest Reserve to the University of Chile for "experimental exploitation and research in silviculture through the School of Agriculture".

The FAO Mission

The FAO Forestry Mission entered the picture in June 1951. E. I. Kotok, formerly Chief of Research of the U.S. Forest Service, came to Chile as Chief of the Technical Assistance groups with projects in forestry, agriculture, fisheries and nutrition. Within six months, three other foresters joined the staff in an effort to help the Chilean Government to outline plans for the management, protection and administration of public forest lands.

In May 1951, a group of forestry-minded young men started a forestry journal, the *Revista Forestal Chilena*, which appeared monthly. Late the next year, this same group, joined by certain forest landowners and lumber producers, organized an association of forestry and timber interests; the Corporación de la Madera, hired a full-time manager, and absorbed the responsibilities of the publication, the name of which was changed to the *Chilena Maderera*.

By April 1952 the interest in forestry and the evident need for men trained in this field culminated in a request from the Chilean Government for additional FAO aid in establishing a specific project in forest education. A supplemental agreement was made "to develop a program of study in silviculture and utilization of forest produce in co-operation with the School of Agriculture of the University of Chile and to instruct Chilean students who had undergone a basic training in agriculture".

FAO would provide:

1. three forestry professors for the university program; one to arrive in late 1952 in order to assist in the formulation of the curriculum; and two others by January 1953;
2. one director for the research center;
3. equipment for the demonstration sawmill and logging project.

The Government of Chile would provide:

1. through the University of Chile, funds for the subsistence of the three professors and incidental expenses of the educational project;
2. through the Ministry of Lands and Colonization, funds for the expenses of the research center, including the construction and maintenance of the facilities.

Recent Developments

With the assurance of technical training being offered locally, a group of agronomy students became interested in a forestry career and two technical courses were incorporated in the third-year unit of agriculture during 1952 under the supervision of Professor Hernán Valenzuela R., one of the Michigan trained foresters. He was later designated by the University of Chile as the chief Professor of Forestry.

The research center was located on the Llancacura Forest Reserve and incorporated the university research lands.

In September, the first FAO forestry professor, Dean Paul M. Dunn (on leave of absence from Oregon State College, Corvallis, Oregon) arrived to assist Professor Valenzuela in preparing the forestry curriculum. By December, the outline of forestry courses had been prepared, reviewed and approved by the Faculty of Agriculture and the Council of University Deans. As stated earlier, the program is to be associated with agriculture, so the proposal is a five-year curriculum with two years of basic agriculture and three years of technical forestry subjects, plus two 10-week periods of practical forestry instruction in summer camps preceding the third and the fourth years. The graduates are to receive forest engineer degrees.

In outlining the course requirements, data from the Accrediting Committee of the Society of American Foresters, the experiences of 50 forestry schools throughout the world and the personal views of the several FAO forestry experts were considered, checked and fitted into the Chilean pattern.

The program of courses by years, which is of course subject to adjustment, is as follows:

First and second years, with agriculture

Mathematics	Botany
Chemistry:	Zoology
general	Meteorology
inorganic and	Geology
physical	Drawing
Statistics	Plant Physiology
Soils	Physics
Surveying	Microbiology

Third year (first year forestry)

Conservation	Economics
Construction	Legislation
Accounting	Measurements
Ecology	Genetics
Development of recreation	Silviculture
	Forest soils

Fourth year

Wood anatomy	Forest entomology
Hydrology	Management I
Machinery	Protection
Applied silviculture	Forest policy
Reforestation	Protection

Fifth year

Management II	Administration
Forest economics	Forest finance
Plant pathology	Forest pathology
Chemical utilization	Seminar
Range and wildlife management	Thesis

Two major modifications in respect of the instructional procedure of the University of Chile were recommended and approved; namely, the adoption of a five-course, two-semester system instead of the practice of having the students enroll in ten full-year courses, and the replacement of the single final examination by a minimum of four tests during each semester.

The seven agronomy students already mentioned enrolled in and completed the 1953 summer camp, located at the research center, about 500 miles (800 km.) south of Santiago. The instruction covered work in dendrology, reconnaissance, improvements, protection, silviculture and exploitation.

Forestry Classes Started

Formal instruction covering the third and fourth year units was initiated on 23 March at Quinta Normal, the site of the School of Agriculture, with six fourth-year and four third-year students enrolled. There are about a dozen forestry-minded young men in the first and second agriculture groups.

The two other FAO professors assisted with the camp project, namely, C. W. Scott (U.K.) and A. Consigny (France). The University is providing another Chilean forestry professor in addition to Professor Valenzuela, as well as the instructors in the associated fields. There is a wealth of instructional talent available to assist with special lectures and courses: the four other FAO forestry experts – E. I. Kotok; A. H. Stein (U.K.); H. L. Person (U.S.A.), director of the research center; L. Hartman (Finland); three men from the Department of Forestry, Eduardo Torricelli, chief; Victor Bianchi, Inspector of Parks and Reserves; and Juan Fuentes, forest engineer; Enrique Rogers, in charge of the Industrial Development Section of CORFO and Jorge Gilchrist, a consulting forest engineer. Carlos Muñoz, director of research for the Ministry of Agriculture and professor of botany, who assisted with dendrology at the camp, and instructors from the University of Law, Economics and Engineering Schools are also available for special classes. Earlier, it was urged that the School of Forestry should be located down in the timber area, but there are evident advantages in associating it with the University of Chile in Santiago.

As noted, the research and field training programs were located at the center in the Llancacura Forest Reserve about 500 miles south of Santiago. These projects are now established; the FAO director arrived in January, the sawmill equipment is on hand, the mill is well along the road to completion and housing for supervisory and instructor personnel is being built. Projects in management and utilization research, as well as special short-term training courses for government and industry foremen and workers, are being outlined. The university foresters will take an active part in this training program as well as the research.

Future Plans

Currently, attention is being given to the preparation of a brochure covering the program and courses offered at the school. Special lectures and informational material will be available to high schools in several areas. Plans for the future will also include extension-type classes, work with 4-H clubs and information for agriculturists. The curriculum will be reviewed and modified if necessary at the end of the current term.

These courses will be available to students from other Latin-American states and it is expected that Chilean foresters might find employment in neighboring countries. Taking advantage of the skills of certain FAO experts now in Chile, it has been agreed to include special courses in tropical forestry in the curriculum.

The major problem of this and other professional schools is the employment of its graduates, in this case the men who finish in December 1954. It is expected that the current interest in this whole program on the part of forest industry executives, Government officials and the public, will be maintained at its present high level, which should bring about a satisfactory solution to the employment situation. Staff members and students alike appreciate that standards of achievement must be high, as the performance of the first Chilean-trained foresters will set the pattern for the whole endeavor.

International Poplar Meetings

Approximately two hundred delegates from nineteen different countries attended the *5th International Poplar Congress*, held in Germany from 29 April to 8 May. In the absence of the President of the International Poplar Commission, Prof. Guinier, the congress was opened by the Vice-President, Prof. Houtzagers in the presence of His Excellency, the Federal Minister of Food and Agriculture, Mr. Niklas, and of numerous high officials of the federal and regional governments. Participants were invited to receptions given by the Minister himself, the Regierunpräsident Dr. Warsch, the Government of Baden-Wuerttemberg, the Mayors of Cologne, Baden-Baden and Karlsruhe, and by poplar-using industries and poplar growers.

Papers were delivered concerning the selection of poplars from the ecological point of view, utilisation of poplar timber and especially small dimension stock, the production of pulp from poplar wood, the role of poplar in the forest economy and its silvicultural system, poplar growing in the Netherlands with particular reference to the spacing and to monoclonal or polyclonal plantations, and the use of poplar for windbreaks. These were followed by interesting discussions.

The itinerary of the study tour included Münster, Cologne, Wiesbaden, Karlsruhe, Baden-Baden, Augsburg, Moos and Munich, allowing first hard investigation of the place of poplar in the agricultural economy, the use of poplar for the reforestation of areas exploited for lignite by open-cast mining, and the improvement of forests by the introduction of poplar.

Two documentary films were shown, one on the cultivation of poplar in Syria and the other on the mechanization of poplar logging operations in Italy. The excellent administrative and technical preparation of this congress enabled all taking part to see for themselves the different aspects of poplar cultivation in Germany, where great importance is attached to it by public authorities and where large-scale planting programs are being considered.

In the course of the Congress, the 7th Session of the *International Poplar Commission* was held at Cologne and Baden-Baden, on 1 and 4 May respectively. About 90 delegates were present from the following countries: Austria, Belgium, Chile, Finland, France, Germany, Greece, Iran, Ireland, Italy, Luxembourg, Netherlands, Spain, Sweden, Switzerland, Syria, Turkey, U. K., and Yugoslavia. The International Union of Forest Research Organisations was represented.

In the course of its meetings, the Commission approved of an outline for an annual report to be submitted by the various national commissions. The necessity of obtaining comparable results in experiments was emphasized, and it was decided to submit for the consideration of the national commissions the papers prepared by Mr. Schreiner and by the National Commission of the

Netherlands on this subject. After comments have been received, its conclusions will later be examined by a committee of specialists from the Permanent Committee, in collaboration with the International Union of Forest Research Organisations. The results of the study will be communicated to the Commission at its next session in 1955.

Owing to the growing importance of poplar wood in national economies and international trade, the Commission expressed the wish that member governments should introduce poplar wood as a special item in their customs nomenclature, and recommended that this question be placed on the agenda of the national commissions. A select committee was entrusted with the study of the best means of

(i) adapting the poplar nomenclature already adopted by the International Commission to the International Code of nomenclature for cultivated plants approved by the 6th International Horticultural Congress held in London in September 1952;

(ii) of establishing the registration of poplar names.

The Commission welcomed and accepted the invitation made by the head of the Spanish delegation to hold the next meeting in Spain in 1955, which would enable the Commission to study Mediterranean poplars in their natural habitat. It was proposed that a regional meeting be held in the Near East next year. The chief of the French delegation hoped that the 1957 Session could be held in France, to mark the 10th anniversary since the Commission's inception in that country.

Mediterranean Pasture and Fodder Development

The second meeting of the FAO Working Party on Mediterranean Pasture and Fodder Development was held at Algiers, Algeria, from 28 April to 2 May 1953, and was attended by delegates from twelve countries: Algeria, Egypt, France, Israel, Italy, Libya, Morocco, Portugal, Spain, Tunisia, Turkey, United Kingdom (Cyprus); the United States sent several observers, and more than 60 technicians attended. The Forestry Division of FAO was represented by W. R. Chapline.

The session, which was marked by the active participation of the delegates who showed great interest in all the problems under discussion, should give stimulus to the research and other phases of work so urgently needed.

Major conclusions of interest to foresters included recommendations that there should be:

1. increased study of means of improving natural pastures or ranges, especially through protection from grazing and range reseeding, and particularly in arid and semi-arid zones;
2. standardization of methods for the determination of range condition or forage productivity and carrying capacity;
3. assembly by FAO of existing maps of the Mediterranean countries, representing the principal ecological factors such as precipitation, soils, floristic zones, etc.;
4. increased acreage of fodder crops and pastures in arabic rotations, including those on irrigated lands;
5. establishment of reserves of hay, silage, etc., including fodder trees for better animal nutrition throughout the year, to meet shortages in drought years, and to assist in reducing the pressure on natural grazing lands;
6. adoption of a uniform method of testing, selection and multiplication of pasture and forage species.

The test plots of the Experiment Station at Maison Carrée were examined and an air and bus trip was made to Laghouat on the edge of the Sahara, to the rural improvement center at Tadjmout — where alfalfa and other forage is being produced and stored for emergencies — and to the sheep breeding, irrigation and arid land experiment station at Tadmit.

Technical Assistance Notes

Owing to financial limitations in the last few months, Technical Assistance activities have had to be restricted to missions already in the field and to new projects of such urgency or economic value as to justify a special effort. It is anticipated that several missions will have to be terminated earlier than originally expected. There has been a revision of Technical Assistance policy and a new basis has been established for future programs. The cessation of activities in some countries is not, of course, of a permanent nature, and in the meantime there will be discussions with governments, on the basis of the preliminary findings of experts, of new programs and projects which will be implemented as soon as the financial situation permits.

The mission that has been working under D. T. Griffiths (U.K.) in *Mexico* for over two years is about to submit its conclusions, having already made a number of very valuable technical reports. One member, P. Poyry (Finland), an expert in forest industries, will forthwith be used in a United Nations *Central American Integration Program* in co-operation with E. Schreuder (Netherlands) of the Honduras Mission, who will deal with purely forestry problems, while K. Hiilia (Finland) will examine pulp and paper production prospects.

E. H. Swain (Australia) is concluding the first part of his mission to *Ethiopia* after the Government has issued a number of proclamations which will serve as a basis for the country's forest policy and for the organization of its forest service.

E. Uhart (France) and W. Varossieau (Netherlands) have completed their mission in *Iran*, while V. Carocci Buzi (Italy), expert on grazing problems, will continue his mission in that country until the beginning of 1954. It is probable that some activities will be resumed when the equipment recommended for purchase by these experts has been delivered.

E. Moser (France) is continuing his work in *Libya* and has submitted a draft forest law; in *Iraq*, the poplar expert, E. Allegri (Italy), has finished

his assignment, while L. Pryor (Australia), a eucalypt specialist, continues his activities. M. van Bottenburg (Netherlands) is still at work in *Syria*.

J. W. Gonggryp (Netherlands) will shortly submit his report on inventory problems in *Thailand* and his conclusions will be implemented with the assistance of FAO, starting in January 1954.

In Latin America, efforts have been concentrated on *Brazil* and *Chile*, but are also to be intensively pursued in *Paraguay*. Under the direction of E. I. Kotok (U.S.A.), a new forestry school has been established in *Chile* by P. Dunn (U.S.A.), C. W. Scott (U.K.) and A. Consigny (France), while in the south L. Person (U.S.A.), H. Stein (U.K.) and L. Hartman (Finland), having received part of the equipment, are organizing a National Training Center for management, logging and industry.

In *Brazil*, R. Gachot (France), as team leader of the large mission for the development of the Amazon, has returned to his post and is to prepare a forest policy for that region and organize a training center for sawmill technicians. K. P. McGrath (Australia) will join him before the end of the year to direct inventory operations, for which he will have to recruit several other specialists, and to organize a logging training center. In the south, L. Rodger (Australia) is advising the Government on silviculture problems of the *Araucaria*. E. Saari (Finland) has completed his mission to *Paraguay* and submitted a general report, the conclusions of which will be given effect by J. French (U.S.A.) who is to continue to act as team leader there to a group of experts on tropical silviculture, wood processing industries and marketing.

In *Haiti*, V. Burns (U.K.) has been instrumental in getting the Government to adopt proposals for the basis of a sound protection and reforestation policy, and is now engaged on specific development work in the Artibonite valley, and in logging in the pine forests.

In *Honduras*, E. Schreuder (Netherlands) will continue his forest policy mission and also implement the recommendations of W. Sandermann (Germany) on resin production.

In the Far East, C. Letourneux (France) is organizing a demonstration mechanical reforestation center in *Ceylon*, and J. McVeigh (U.K.) is advising the Government on the utilization of modern machine tools. In *Burma*, K. Miedler (Austria) and an assistant are developing seasoning and preservation methods and new wood-processing techniques that will contribute to a solution of the housing problem. In *Indonesia*, L. Cermak (France), an expert on mechanical logging, assumed a new post on 1 July.

In co-operation whith the Government of the *Philippines*, H. G. Keith (Canada) has successfully organized a large logging training center; at the moment he is advising on forest policy and will in particular assist the FAO-United Nations Technical Assistance Administration pulp and paper mission. A. Hviid (Denmark), S. Bugge and B. Haaheim (Norway), the three forestry officers in this mission, have submitted their reports.

In *India*, H. Huber (Switzerland) has finished his work on logging and timber transport. H. Seitz (Germany) is assisting the Dehra Dun Institute staff on wood mechanics and wood structure problems. The conclusions of the J. Von Monroy (Austria) mission to *East Pakistan* are now being implemented in co-operation with the United States Technical Co-operation Administration.

FAO continues to be active in *Austria*, particularly in the field of research, through M. Näslund (Sweden) and G. Hunt (U.S.A.), and in Yugoslavia, where H. Leibundgut (Switzerland) started on a new mission at the beginning of the year, and whither J. de Vaissière (France) has gone to advise the Government on the co-ordination of the forest policies of the Republics of the Union.

The years 1952 and 1953 saw the development of many other activities, particularly studies on the prospects for expanding and decentralizing paper and pulp production. The following specialists have been engaged in field work:

H. Baars (Netherlands): *Haiti, Cuba, Dominican Republic, Brazil;*

E. Forrest (U.S.A.), W. Barbour (U.S.A.): *Ecuador, Peru, Colombia.*

H. Mueller-Clemm (Germany): *Mexico;*

R. Runkel (Germany): *Paraguay;*

J. Messines (France), R. Maronne (Germany): *Turkey, Iraq;*

A. Sundelin (Sweden), R. von Dueckelmann (Austria): *Greece, Portugal;*

A. Sundelin (Sweden): *Pakistan, India.*

R. Maronne (Germany): *Laos, Cambodia, Indonesia, Thailand;*

J. von Monroy (Austria): *Laos, Cambodia, Indonesia;*

Fellowships

Some 32 fellowships have already been granted in 1953 to technicians from Austria, Brazil, Ethiopia, Haiti, India, Iran, Thailand and Yugoslavia but, here too, activities have had to be curtailed. Particularly valuable results have been obtained from courses in the Netherlands (Delft School for aerial surveying), in Cyprus, Australia and Puerto Rico, as well as at North American and European forestry schools.

The municipal forest at Karlsruhe-Durlach, Germany, visited recently in the course of the 5th International Poplar Congress. The photo shows old coppice with standards, improved by the introduction of poplar and gradually being converted into high forest with undergrouth of alder. In such stands mother trees are chosen which will produce types corresponding to varying ecological conditions. In the foreground, examples of Populus euramericana f.regenerata.

Equipment News

Interest in the development of forest utilization and woodworking industries is reflected in the continued requests for information on new equipment. FAO's Forestry Division collects such information and passes it, on request, to Member Governments. Some of the information collected is published here. FAO accepts no responsibility for the claims put forward by manufacturers.

M.A.N. TRACTORS (*AS 330 FH and AS 330 FA*). — 30 h.p. model AS 330 FH rear wheel drive; 30 h.p. model AS 330 FA 4-wheel drive; 4 cylinder diesel engine, 1500 r.p.m. A 2.5 h.p. bosch starter permits engine to start even in the coldest weather without any pre-heating equipment. *Specifications*: speeds; 5-speed gear box with speed range of 2.2-12.5 m.p.h. (3.5-20 km.p.h.) or with 6-speed gear box having crawling speed of 1.1 m.p.h. (1.8 km. p.h.): max. drawbar pull; rear-wheel drive, 3,300 lb. (1,500 kg.), 4-wheel drive, 4,000 (1,814 kg.), max. trailer load on level, 13.2-16.5 short tons (12-15 tons); length, 9.88 ft. (3,015 mm.), height, 67 in. (1,700 mm.). *AS 330 FH*: width, 62.2 in. (1,580 mm.); weight, approx. 3968 lb. (1,800 kg.); min. turning radius, approx. 100 in. (2.5 m.). *AS 330 FA*: width, 66.1 in. (1,680 mm.); weight, approx. 4188 lb. (1,900 kg.); min. turning radius, approx. 118 in. (3 m.).

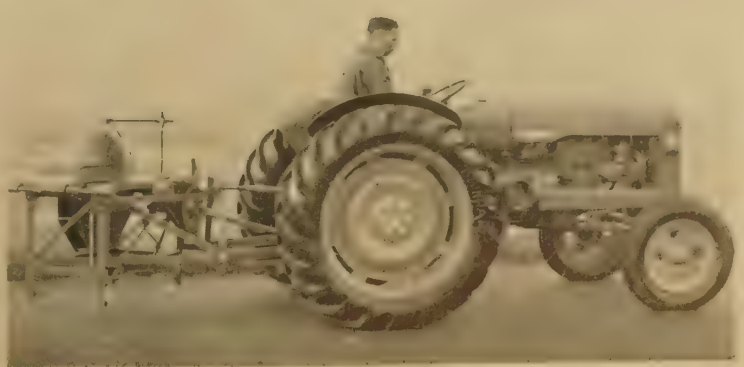
M.A.N. Ackerdiesel, Maschinenfabrik Augsburg-Nürnberg, A. G., Katzwanger Strasse 101, Nürnberg 24, Germany.

TWO-DRUM WINCH (*Models M. 5, M. 8 and M. 10*). — Winch, together with a 15-20 h.p. gasoline or diesel motor, is mounted on a two-wheel undercarriage. Self-opening guide pulleys and cableway supports are in steel and wood. *Specifications*: *Model M. 5* consists of a main drum holding 500-700 m. cable 9 mm. diameter and running at 0.85 m./sec. or 1.40 m./sec., giving a maximum drawing force of 1,800 kg. Auxiliary drum running at 1.30 m. or 2.00 m./sec. serves for the smaller auxiliary cable (1,000-1,400 m., 5 mm. diameter). *Model M. 8*, giving cable speeds between 0.5 and 4 m./sec. and exerting a max. drawing force of 3 tons. The main drum normally holds 750-1,000 m. cable of 9.5-11 mm. diameter. *Model M. 10* has 1, 2 or 3 drums and a max. drawing force of 4 tons.

Alois Krasser Maschinenbau, Edelschrott, Steiermark, Austria.

WREKIN MOUNTED SAW-BENCH. Standard equipment includes 24 in. (61 cm.) or 30 in. (76 cm.) diameter saw blade, top saw guard and parting knife, fully adjustable fence plate slotted to allow wood packing to be fitted if required; a machined feed roller to fit the fence spindle, and bottom saw guards. *Specifications*: table, 4 ft. (1.2 m.) long, 2 ft. (0.6 m.) wide, 2 ft. 6 in. (0.7 m.) high - adjustable; 30 in. (76 cm.) saw gives cut of 12½ in. (32 cm.), 24 in. (61 cm.) saw gives cut of 9½ in. (24 cm); weight, 532 lb. (240 kg.), net weight, 476 lb. (216 kg.).

The James Clay (Wellington) Ltd., Wrekin Foundry, Ketley, Wellington, Shropshire, England.

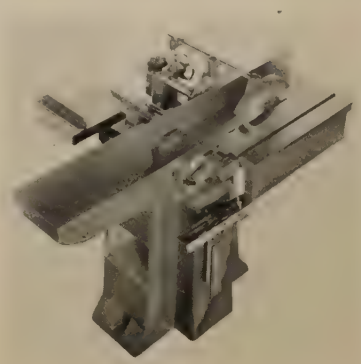


JUNIOR WARPING TUG. — *Specifications*: length: 30 ft. (9 m.); beam: 8 ft. (2.4 m.); depth: 3 ft. 6 in. (1 m.); draft: 2 ft. 2 in. (0.7 m.); *plating*: sides and bottom, 3/16 in. (5 mm.), deck, 10 gauge (2.58 mm.); *frames*: 3/8 in. × 2 in. (1 × 5 cm.) spaced at 18 in. (46 cm.); *keelsons*: 6 in. (15 cm.) – I/beam; *decks*: conforming with shape of hull with 4 in. (10 cm.) bulwark. *Wheelhouse*: combined engine room and wheelhouse removable as one unit. Entirely built of 16-gauge (1.29 mm.) steel plate. Controls all within reach of helmsman. *Power*: Lister diesel 30 h.p. engine with 2:1 reduction and hull cooling; 100 gallon (455 liter) fuel tanks. *Winch*: Maffey winch can be provided with capacity of 2,000 ft. (610 m.) of ½ in. (1.3 cm.) cable, with level winder, and all necessary sheaves.

Maffey Steel Boats Ltd., Fort Frances, Ont., Canada.

RICHARDSON GRADER (*Models 16-H and 18-H*). — Large blade grader which requires only 2 h.p. motor to pull it with blade lifted; swinging motor base with five holding positions permits motor to operate in near level position on incline grader work; adjustment is made by operator in moving one or two of the 10 hydraulic control levers. *Specifications*: *Model 16-H*: min. h.p. 62; weight without scarifier, 14,800 lb. (6,700 kg.); wheel base, 21 ft. 3 in. (6.5 m.). *Model 18-H*: min. h.p. 78; weight without scarifier, 15,900 lb. (7,200 kg.); wheel base, 21 ft. 3 in. (6.5 m.).

Richardson Road Machinery, Saskatoon, Saskatchewan, Canada.



PLANER, CIRCULAR SAW AND BORER (*Type QJ*). — 9 in. (23 cm.) surface planer with 4 ft. (1.2 m.) overall length of precision ground table can be transformed quickly into circular sawbench which supports timber between saw and fence. The ½ in. (1.3 cm.) capacity borer has a 12 in. × 8 in. (30 cm. × 20 cm.) precision ground table and is usable irrespective of whether saw or surface, or neither, is operating. Fence cants to 45° and serves both planing and sawing operations; its micro-accurate adjustment is made instantly by means of a rack and pinion. *Specifications*: Max. planing width, 9 1/8 in. (23.3 cm.); speed of cutter block, 6,000 r.p.m.; 1½ h.p. motor; max. size of circular saw, 9 in. (23 cm.); max. depth of cut, 2½ in. (6.4 cm.); speed of saw, 10,600 ft./min. (3,200 m.); weight of planer, saw and borer (with electrics), gross, 840 lb. (381 kg.), net, 672 lb. (305 kg.).

Houghton Engineers Ltd., Fence Houses, Co. Durham, England.

SANDER WITH PLANER HEAD. — 9 in. (23 cm.) tool for removing bark, fitted with a rotary planer head; performs many wood surfacing and shaping operations. Also available is a planer head with rounded surface for deep gouging. *Specifications*: weight, 18 3/4 lb. (8.5 kg.); no-load spindle speed of 4,000 r.p.m.; optional spindle speed of 5,000 r.p.m. also available; overall length, 19 1/2 in. (50 cm.). Planer head shown has a flat face for surfacing and semi-finishing. Sander uses standard 115 or 220 voltage with universal motor.

The Black and Decker Manufacturing Co., Towson 4, Maryland, U.S.A.

ELECTRICALLY HEATED VENEERING TABLE. — Table constructed of sheet iron; frame composed of electrically soldered sections. Electrical apparatus situated in lower part of table with electrodes submerged in water tank; heating by steam gives uniform temperature of 105° C. Level of water regulated by stopcock. Table has anti-rust base. *Specifications*: length, 1,800 mm.; width, 600 mm.; height, 750 mm.; approx. weight 200 kg.; power, 5 kw.; time required for heating, 15-20 minutes.

Elcalor S.A., Fabrique d'Appareils Electrothermiques, Aarau, Switzerland.

CRANE BELOTTI. — Crane is equipped with 4-cylinder petrol engine and, on request, with a diesel engine; 4 speeds forward, 4 reverse; hydraulic brakes and leverage system. Petrol consumption, 1 liter for 3 hrs. operation. Max. load, 7 tons.

Belotti, Via Francia, Genoa, Italy.

News of the World

The items appearing here are condensed selections of news thought to be of interest to readers of UNASYLVA. *They are grouped alphabetically by countries under headings currently used by the Forestry Division for its [illegible]. FAO assumes no responsibility for statements in news items accepted in good faith from outside contributors.*

General

ALASKA

• B. Frank Heintzleman, regional forester, has been appointed Governor of Alaska. He has been in charge of National Forests in the territory since 1937 and, due largely to his negotiation with private industry, a pulp plant with investment of $46,000,000 has recently been set up. He had a large part in drafting the long-term timber supply contracts under which industries will operate and, in addition, has taken a leading part in many of the community development and improvement projects affecting the territory.

HONDURAS

• A technical assistance officer, E. J. Schreuder, is trying to interest the authorities in Honduras in creating a National Forest Park in a little-known area to the extreme northwest of the country, bordering on the Caribbean Sea.

Between elevations of 1,600 and 2,000 meters along the Sierra de Omoa occurs a magnificent stretch of virgin forest which, unfortunately, is already being eaten into by lumbering operations, shifting cultivation and fire. The forest consists of mixed hardwoods and pines (*Pinus pseudostrobus*) which are thought to be between 200 and 300 years old. Trees up to 60 meters (200 ft.) in height and 1 meter in diameter are common. There is a heavy undergrowth of young trees, ferns and other vegetation. Orchids abound. Clear streams flow down from the hills and wildlife is abundant. Quetzals and turkeys which are elsewhere almost extinct in Honduras, are plentiful, and tapir, panther and deer are so far undisturbed.

It would be a tragedy if this magnificent area were to be lost wholly to the national heritage through ignorance, apathy or greed.

Fundamental Science

GERMANY

• The most important article in the 1951-52 Yearbook of the now 60 years' old German Dendrologic Society gives the results of an inventory of foreign forest trees planted in Germany in woods and parks. The inventory covers 12 American species, namely: *Larix laricina, Pinus contorta latifolia, P. monticola, P. ponderosa, P. resinosa, Thuja plicata, Tsuga heterophylla, Acer saccharum, Betula lutea, B. papyrifera, Fraxinus nigra, Liriodendron tulipifera.*

At least some of these species may be of importance for German forests. The inventory does not cover: *Pseudotsuga douglasii, Abies grandis, Picea sitchensis, Pinus strobus, Quercus borealis.* These species have already proved to be very valuable to German forests.

Thanks to the helpful co-operation of all German foresters and of many landed proprietors, the Society received 371 answers to its questionnaires, of which 121 were concerned with *Liriodendron tulipifera.* The answers contained descriptions of planting sites, size of the plants when planted, age, height, diameter and enemies of the plantations.

The results of the inventory show good and very good growth of *Thuja plicata, Tsuga heterophylla, Acer saccharum, Betula lutea* and especially of *Liriodendron tulipifera.*

A second inventory covering 12 other American species, as well as some from Japan and the Balkans, is already under way.

UNITED STATES OF AMERICA

• In 1941, a program for the improvement of forest species was initiated at the Southeastern Forest Experiment Station of the U.S. Forest Service. After examination of a large number of slash (*Pinus elliottii*) and longleaf (*P. palustris*) pines reported to be high yielders of naval stores, 12 were selected as parent plants because their yield was more than twice as great as the average tree of the same diameter growing on the same site. Cuttings from the crowns of these 12 which have been rooted successfully have now reached the age of 7 years in a plantation from which cones have already been collected. The form and rate of height growth are reported to be outstanding.

Selection of superior trees is now being made on the basis of fast growth rate and good form instead of gum yield, which is considered to be a function of rate of growth.

Using micro-tapping techniques, gum yields of progeny of wind-pollinated cones from high-yielding and low-yielding mother longleaf pine trees have been analyzed. The results indicate that gum yield is an inherited characteristic, that yields of the 17-year old longleaf pine trees above-average mother trees were significantly higher than yields from below-average trees.

Mass selection is being carried on in nurseries to find exceptionally vigorous seedlings or mutations. A small plantation of such selected seedlings has shown interesting extremes in size and needles. These are being studied cytologically to see if chromosome numbers can be related to these characteristics.

Similarly, mass selection is being conducted in old stands to demonstrate variation in diameter and height growth, form, and branch size, as a guide to silvicultural practice, particularly in selecting seed trees to be left for regeneration purposes after cutting.

Techniques are also being developed to improve rooting of cuttings, grafting, and induction of early flowering. Actual breeding work is also being actively carried on, particularly with slash pine, and with hybrids of slash longleaf pines, and loblolly (*Pinus taeda*) slash pine, and others.

Silviculture

UNITED STATES OF AMERICA

• The effectiveness of shelterbelts in modifying wind velocity, and the effects of wind have been made the subject of tests in several countries, principally the U.S.A. and the U.S.S.R., over a good many years. But, since different methods have been used and some foresters, chiefly in the U.S.S.R., have not reported on their methods, the effects of windbreak have been appraised differently.

The U.S. Soil Conservation Service has recently conducted a series of wind-tunnel studies to determine:

1. effect of barrier shape on wind flow patterns;
2. effect of different velocities about a barrier of constant shape;
3. determination of the zone of influence of barriers of different shapes;
4. evaluation of wind-tunnel results in terms of atmospheric conditions.

In the tests, three known geometrical shapes of barriers and a model tree windbreak were used, and the results are presented in mathematical form. A result of great interest is the reduction in average horizontal wind velocity in relation to kind of

barrier as summarized in the following table in which H = height of barrier:

Object	Distance at 0.1 H to		
	75 % reduction	50 % reduction	25 % reduction
Vertical plate	13.0 H	15.5 H	21.5 H
Triangular shape .	10.5 H	15.0 H	20.5 H
Cylindrical shape .	7.0 H	9.0 H	14.0 H
Model trees	1.0 H	13.5 H	27.0 H

The model tree barrier caused a more extended zone of reduction in velocity than any of the other shapes tested.

Union of Soviet Socialist Republics

• In October 1952 the Ministry of Forestry held a five-day conference of representatives of forest schools, regional foresters, and members of the Ministry on the new *Instructions for Cultural Cuttings*. In the course of this conference discussions took place on the theory and practice of thinnings, improvement and intermediary cuttings, known in Russia as "cultural" cuttings, to show that the purpose is largely to improve the forests and only in a lesser degree to obtain useful material. These discussions are of interest in that they reflect the thinking of some outstanding Russian silviculturists on the nature and growth of forests.

Cultural cuttings in the U.S.S.R. are no longer of a secondary importance. They form now an essential activity of the Ministry of Forestry. During the five-year period between 1909-1913 improvement cuttings in the then state forests were made only on about 35,000 hectares; during 1936-1940 the forest area covered by improvement cuttings reached close to 4 million hectares. During 1946-1950 cultural operations extended only to the forests of European Russia. Now they include also large areas in the Urals and Siberia, involving millions of hectares of forest land and tens of millions of cubic meters of timber.

The basic elements of the problem are: what kind of trees should be removed from the stand and what volume of wood should be cut per hectare? The kraft classification of trees on the basis of dominance (dominant, co-dominant) used for decades is considered inadequate; first, because it applies only to pure even-aged stands and second, because the mere position of a tree in the stand does not indicate its energy of growth or its stage of maturity. For this reason some of the participants in the conference, largely professors of forestry schools, suggested that the trees in the stand be divided into 3 large classes: class I - trees of vigorous growth: class II - trees of retarded growth, and class III - trees of poor growth: also that each class should be further subdivided into (*a*) trees of retarded development, and (*b*) trees of rapid development.

Stress is laid on the *stage of development* — a new concept that crops up in all Russian silvicultural considerations. By analogy with some agricultural crops, which pass their biological cycle from the embryonic stage through maturity, flowering to fruition and death, foresters divide the life of forest trees also into three stages of development — juvenile, mature and senile. Senility, according to this concept, is characterized by abundant seed-bearing.

The object of improvement cuttings therefore, according to Prof. V. G. Nestorov, should be in the case of pure stands, their "physiological rejuvenation" by removing trees that show signs of senility, irrespective of the class in which they occur whether dominant, intermediate or even suppressed. In practice, this means cutting both "from above" and "from below". Experience has shown that this leads to excessive opening of the stands. In mixed stands only "liberation" cuttings are recommended, i. e. removal of trees interfering with the growth of the selected trees. These and several other similar proposals were not accepted by the regional foresters and the representatives of the Ministry on the grounds that they must still be tested in actual practice, that the cultural cuttings must be conducted in the field by forest rangers and other lower forest personnel, and to this end the newly revised *Instructions for Cultural Cuttings* were issued, which are briefly as follows:

To carry out intermediate cuttings, trees in the stands are divided into 3 categories: 1. the best, 2. the useful (auxiliary), 3. the interfering (the ones to be cut).

1. The best trees must have a long trunk clear of branches for not less than 7 meters, a normal uniform crown, $\frac{1}{3}$-$\frac{1}{4}$ of the tree in height and be well rooted. Such trees must be left, even if they are bearing abundant seed; in fact, this is an advantage since they constitute a source of good seed.

2. The "useful" are those trees which help the clearing of the better trunks of their branches, formation of their trunks and crowns, or have soil-protective or soil-improving qualities. Any tree can serve the purpose, whether it bears much or little seed. The functions of such trees are entirely that of service to the better trees.

3. All trees, irrespective of species, height or diameter, which interfere or hamper the growth and development of the selected "best" and "auxiliary" trees and all crooked, dying and infected trees must be removed from the stand.

At the same time the amount of wood to be removed in intermediary cuttings has been greatly reduced. Thus between 1936-40 it amounted on the average for the entire country to 14.4 m.³ per hectare; between 1946-50 it was reduced to 12.6 m.³ per hectare and now stands at 10.9 m.³ per hectare.

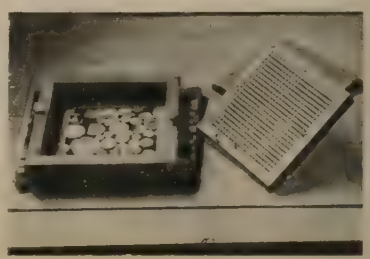
Mensuration and Surveying

Germany

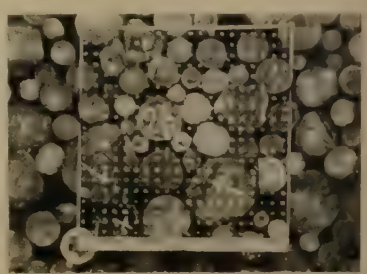
• The exact determination of the solid volume of wood stacks and of the related conversion factors by the xylometric method, which measures the water displacement of each log, or by measuring each stick separately with a caliper involves considerable work. Moreover, the second method cannot be used in the case of split cordwood.

Making use of H. S. Mountain's [1] reports, the following practical method of determining the volume of stacked wood has been developed.[2]

A ruler 1 meter long is suspended by means of a white ribbon 3 meters long from 2 nails placed horizontally 1 meter apart and with the camera facing the center of the square photographed so that each side of the square is reduced to 10 cm. (Minor errors can be corrected by appropriate mounting of the photographic-paper).



This photo is placed in a wooden frame which fits the photographed square and perforated by 400 gramophone needles placed at an equal distance of 4 mm. on an exactly fitting cover.



The punctured photo is then used for counting the number of incisions in the wood which give the exact percentage of solid volume.

Rotten pieces are marked with a chalk cross, thus enabling determi-

[1] H. S. Mountain, "Determining the solid wood volume of four feet pulpwood stacks", and "Wood evaluation and its significance", Minutes of meeting of the American Pulpwood Association, 4-5 October 1950.

[2] *Das Papier* 6, pp. 524-526, 1952, Darmstadt, Germany.

nation of the approximate percentage of unsound wood.

Experiments showed that the results gained this way coincided with an average error of ± 1 percent with those gained by piece-wise measuring and cubing, and, if both sides of the stack are photographed, with an error of less than 1 percent.

To measure very large stocks, e. g. whole shiploads, it is sufficient to repeat this procedure every 5 or even 10 meters.

Forest Management

Sweden

• One section of forest economics now being studied closely is that of the business side of forest management, in which forest enterprise is looked at from the point of view of a business concern. The purpose of this research is to ascertain, through statistical calculations over a sufficient number of years, the cost of a forest enterprise based on sustained yield, and the possible financial advantages of certain felling policies, running expenditures and investments.

Such a study has recently been made of the Swedish State forests which are managed as a semi-commercial enterprise; it is based on statistical data gathered on these forests between 1911 and 1950.

The most important consideration in a study of this kind is the question of self-cost prices — the ratio of production cost per unit of output (including management costs and possibly logging costs) to selling price of the same unit. Efficiency of production can be checked by examination of the variations in such ratios. Comparison of them as between forests under different general economic and ecological conditions is also the most accurate way of assessing the effect of such conditions from the financial standpoint.

For any given region there is, in theory, an ideal balance between income and expenditure that will yield maximum profit. The aim is, therefore, to find the annual management expenditure for different economic and natural conditions consistent with this ideal balance. Such studies always assume sustained yield or an attempt by the forest owner to achieve it; but, unlike the aim of national policy, which is to obtain the highest sustained yield in order to meet the country's needs, the objective here is so to fix the level of sustained yield that, having regard to the financial outlay necessary to attain such a level, the owner can make as much profit as possible. When the owner has determined exactly how intensive should be the silviculture methods to be applied to his forest, management expenses remain unaltered, whatever the annual cut. Consequently, a rise in the latter brings down production costs per unit of output, and a drop in cut raises that cost. Such variations are of small importance in practice in a normally-constituted forest worked on a sustained yield basis. They should, however, be given considerably more attention where the forest composition is abnormal, and the attempt at sustained yield automatically gives rise to variations that can be quite substantial in terms of annual cut.

The present research has brought out some interesting facts. It shows, for example, that in the northern region of Sweden where a more extensive silviculture is practised a higher profit is obtained from the sale of felled wood than from standing timber. Exactly the contrary is the case in the south where, however, the proportion of different types of the products of fellings is also very different from that in the north. In 1950, for example, the ratio of fuelwood to total cut was 15 percent in one northern district, and over 40 percent in one southern district; the ratio of pulp wood was 45 percent in the north against 30 percent in the south.

Examination of the distribution of forest management expenditures per hectare of productive area between 1921 and 1950 shows that they rose substantially, but this is due in part to currency depreciation. Of all the items in the total expenditure, road maintenance and construction costs led in 1950 with 39 percent as against 26 percent for administrative costs, whereas in 1921-25 cost of administration was the biggest item at 40 percent, with road maintenance and construction at 29 percent. Pure silvicultural costs rose from 6 percent in 1921-25 to 12 percent in 1950.

Average stumpage value (estimated standing) per hectare naturally declines from north to south; but the same is true of management expenditure per hectare. However, the ratio of the one figure to the other, at 63 percent for the State forests as a whole, varies little from north to south. The outside figures are 53 percent and 74 percent. In one district, however, the ratio is 86 percent.

There is a substantial variation from one region to another between net profits from felling sales to the unit of output, but the variations in net profits to unit of area are much greater (10 times greater in the southern districts than in the northern); thus, as regards general conditions in Sweden, this latter ratio is a much more sensitive and important index of the financial value of a particular forest.

Industry and Trade

Saudi Arabia

• Saudi Arabia is exporting packaged dates for the first time in its history, following technical advice from an FAO officer, thereby opening up a new export industry that is expected to increase the wealth of the country.

Dates have been exported in bulk from Saudi Arabia for many years, but the idea of packaging them in attractive and portable containers originated as a means of providing an appropriate souvenir for sale to the 150,000 Moslems who yearly make their pilgrimage to the holy cities of Islam.

The FAO officer, who was familiar with packaging dates in his own country, was asked by the Saudi-Arabian government to advise and assist in the selection and installation of processing equipment and to design a package. Machinery for the cellophane and cardboard wrapping was brought from the United States.

Saudi Arabia has just started assembly-line packaging, which is expected to reach 50 tons of dates during this year, and the first two packages to leave the country were flown to FAO headquarters.

United States of America

• A new development laboratory for pulp and paper products has recently been set up by the Crown Zellerbach Corporation, with an investment of $500,000.

This new laboratory built beside Crown Zellerbach's huge specialty paper plant at Camas, Washington, has its own small-scale paper mill, complete from chipper to coater, and aims at producing new products in papers and from pulp liquors hitherto wasted. The old laboratory at Camas, established as the company's research center 13 years ago, will continue its workbench experiments, while the new laboratory, in its 200 by 75 foot (61 × 23 m.) building, is taking over the job of application. The two have divided up the former staff of 35, and have added another 10 or so.

Researchers will investigate new products and the development laboratory will then work out techniques to produce them on a commercial scale. This has been done many times before, of course, but the miniature mill will speed up the task, since it can carry out all processes of the big plants, thereby relieving them of making test runs for experimenters, always a costly interruption to commercial operation.

New ways of "tailoring" papers to meet special needs will be hastened; among the more recent being a fungicidal wrap for citrus fruits to arrest mould. Wood species not hitherto widely used for paper may now be adapted in the new laboratory. Lodgepole pine, ponderosa pine and other species from the West's inland reaches may be better adapted, and even non-wood sources of fiber will be better studied.

But perhaps of greatest significance is the one-third of floor space reserved for the chemical engineers and any

pilot plants they may design for study of pulp liquors. Little more than half the log is cellulose fiber; the rest is largely lost in liquid waste. Lignins and other materials in the pulp liquor offer an almost untapped commercial resource. Crown Zellerbach chemists have developed their first market item from this waste in the form of Orzan, derived from ammonia base pulp liquid. It has been found valuable as plant fertilizer, as a dispersing agent in asphalt emulsions, gypsum, clay slips and sprays, as a base for synthetic resin plywood glues, and as a binder in fuel briquettes, hardboard and road surfacing.

In its confidence in the future of such items, the company has established an industrial products division which will develop appropriate distribution methods.

The little mill will also help earn its keep commercially, since it can easily turn out small amounts of certain papers which lack a sizeable market, or can supply samples where runs of a few hundred pounds are sufficient.

Forest Products and their Utilization

United Kingdom

• The Forest Products Research Laboratory at Princes Risborough has published a very comprehensive lens key for the identification of hardwoods, covering a wide range of species from all over the world which have long been used, together with a large number which have only recently appeared on the market. The method, which was developed at the laboratory 15 years ago, has fully stood the test of time. The key is for the use of those with a sound general knowledge of wood structure and not for those lacking previous experience.

The key uses 87 features grouped into pores, soft tissue, other features, rays, physical properties of sound hardwood, geographical regions and growth rings. The system involves the use of multiple entry perforated cards on which the data are recorded by clipping out the appropriate holes. The comprehensive listing of timbers by botanical family and species and common name, together with the feature numbers appropriate, is given, as well as excellent microphotographs of selected wood specimens. A separate index and check list shows the botanical family under which anatomical description of the timber may be found.

Forest Policy

Chile

• A decree creating an Agricultural Development Committee has been signed by the President of the Republic of Chile. The committee, which is reinforced by two subcommittees, is required to submit to the President, within a period of 90 days, a concrete program of agricultural and forest development for Chile, together with the economic studies necessary for its achievement. The development program is to be based on a report prepared a few months ago, at the request of the Chilean Government, by a group of experts of the International Bank for Reconstruction and Development and FAO.

The decree contains a detailed description of the chief reasons for the adoption of an agricultural and forestry rehabilitation program. They are mainly the low productivity of the agricultural sector, the resulting increasing need for imports of agricultural foodstuffs, and the desire to lift the standard of living of peasants and farmers, to slow down the process of erosion, to harmonize agricultural and forest development with the rapid strides made by industry, etc. The need for co-ordinating agricultural and forest development with the over-all economic possibilities of the country is clearly expressed in the decree.

United States of America

• During 1952, the acreage of State and private forest lands placed under organized protection from fire, under co-operative federal and state financing, was increased by some 3-5 million acres (1.2-2 million ha.). This reduced the area without organized fire protection to about 60 million acres (24 million ha.), or some 14 percent of the total area of State and private forest lands needing fire protection. The Engelmann spruce beetle epidemic in Colorado — the largest beetle control project ever undertaken in the United States — was checked, but an equally serious epidemic of the same beetle developed in northern Idaho and western Montana. Larger areas containing wind-blown and bug-killed timber were surveyed in western Oregon and Washington in preparation for salvage operations.

Some 462 million forest tree seedlings, enough to plant about 500,000 acres (200,000 ha.), were produced during the year. About two-thirds of the total was distributed by 43 States and 2 Territories under a co-operative program with the Federal Government; the balance by other Federal and State agencies, forest industries and private commercial nurseries.

Considerable effort was also devoted to programs for improving forest management on small privately owned woodlands, which aggregate more than one-half of all the forest land in the country. About 28,000 small owners of woodland, with 2½ million acres (1 million ha.), of forest land, received technical assistance in timber cutting, woodland management and marketing from the 260 service foresters employed.

This program of assistance was complemented by the educational programs of the Agricultural Extension Service, and by practical demonstrations of good forest management given woodland owners at the research centers of the Federal Forest Experiment Stations. State governments, industry associations, numerous pulp and lumber companies and other organizations also conducted general educational programs and engaged in demonstrations designed to encourage good forest practices.

During the year several large life insurance companies entered the forest credit field, and in the State of New Hampshire it was announced that forest fire insurance was available from a private insurance company.

Substantial gains were also made in improving the condition of national forests and other public forest lands. For example, on the national forests about 50,000 acres (20,000 ha.) were planted or reseeded to trees, and timber stand improvement work was carried out on some 700,000 acres (280,000 ha.). Nearly 60,000 acres (24,000 ha.) of national forest range lands were reseeded to palatable forage species and over 200 miles (320 km.) of range fence and corrals were constructed.

Approximately 4.8 billion board feet (22 million $m.^3$) of timber were harvested from the national forests during 1952. Receipts from the sale of this timber amounted to 66 million dollars, an all-time record high for annual value of such timber.

Well-organized research on all phases of forestry and forest products utilization was continued. One notable development in this respect was the initiation of a nation-wide program for a comprehensive timber resource review to assemble up-to-date figures on timber resources and to appraise progress and programs.

Short range programs designed to increase output of forest products and industrial capacity for defense purposes were also continued. Under this program accelerated tax amortization has been granted to more than 110 pulp companies, plywood plants and other forest industries to encourage construction or expansion of new plants.

Selected Reviews

FORESTRY AND ITS CAREER OPPORTUNITIES. The American Forestry Series. Hardy L. Shirley. pp. 492. Illus. McGraw-Hill Book Company, Inc. New York. 1952. U.S. $ 6.50.

Since its inception more than 20 years ago, the American Forestry Series has reflected the growth of forest science as accepted by administrative organizations, the profession and forest schools. In this excellent volume, the author gives a broad outline of all the questions relating to the development of the forest and its place in national and world economy, and handles them with the lucidity of an expert who thoroughly knows his subject.

Technical problems have been given only summary treatment, for the author's purpose was not to write a treatise on silviculture and forest economics and wood technology, in respect of which he refers the reader to the specialized literature on the subject, but rather to direct attention to the many and varied problems of forestry. The book is chiefly intended for young people, to acquaint them with the prospects of a career in forestry. As such, it will be equally valuable for educators and vocational guidance counsellors.

The author defines forestry as the management and utilization of forest lands and forest products for the benefit of mankind. This implies silviculture proper, forest economics and the many industrial uses of timber and secondary forest products. As to the usefulness of forests in general, he quotes the very pertinent view of a high U.S. Government administrator to the effect that forests are worth the money spent on their care and conservation because of their value in wildlife, soil and watershed protection and for the recreational and relaxation facilities they afford city folk, and that the timber harvested represents pure profit.

He then reviews the forest resources both of United States and the world, the latest forestry achievements in the United States and proposed future programs.

The final interesting chapters are devoted to the profession of forestry: what branch or field seems most likely to fit the abilities and wishes of individuals; the kinds and characteristics of employers in each field; the personal characteristics and capacities most likely to lead to success in each field; the probable conditions of employment and possible rewards in each; the kinds of formal training, both narrowly technical and broadly educational, best preparing men for chosen careers. All the opportunities for a career in forestry in the various administrations and public and private organizations and in the wood industry are considered in great detail and their advantages and disadvantages analysed.

DIE ROTEICHE (The Red Oak). Franz Bauer. pp. 106. Illus. J. D. Sauerländer's Verlag. Frankfurt a. M. 1953. D.M. 10.20.

The red oak, *Quercus borealis* Michaux, is a native of the east of North America which has also been cultivated in Europe, especially in Germany, since the end of the last century.

The examination of experiments in cultivation, on the basis of 114 sample-areas and 15 comparison-areas for oaks in West Germany and Holland, show that the increment of the red oak in the unmixed stand is characterized by quick growth in the young tree and a marked decline at the age of about 80. As, up to now, no other species of wood shows a similar development of growth in Germany, this process needs to be observed in sample areas over a long period.

Compared with the European oak, the red oak up to the age of 60 and on the same site provides about 20 to 30 percent more wood with a minimum diameter of 7 cm. But the growth of the European oak at a higher age is more sustained, and on favorable sites attains the same total produce at the age of 100 years, although in weaker diameter classes. In addition, the oak-stems have a more full-bodied growth.

The wood of the red oak is less uniform in structure than that of the European oak, and therefore has only limited use in the manufacture of luxury veneers and furniture. It is, on the other hand, particularly well suited to the manufacture of carts, wheels and other construction requiring wood of high solidity, and it is for such purposes that the cultivation of the red oak needs to be developed.

The results of the experiments made to date in West Germany show that the red oak could make a valuable contribution to forest resources. Furthermore, its growing-capacity on poorer soils and its silvicultural superiority enable it to replace *Quercus pedunculata* and *Q. sessiliflora*, on many sites. For the individual forest farmer, in particular, it is the oak of the future.

PULP AND PAPER — CHEMISTRY AND CHEMICAL TECHNOLOGY, Vols. I and II. James P. Casey. pp. 1404. Interscience Publishers, Inc. New York. 1952. U.S. $ 15.00 each vol.

This two-volume work is based on the belief that paper-making is essentially a chemical process — a fact often obscured by the remarkable engineering achievements of the industry — and that too little emphasis is put on the fundamental chemistry of paper, its manufacture and its use.

Paper-making is an ancient art, but until the last generation its practices were often surrounded by secrecy and development in technique was slow. Recently, co-operation in the sharing of ideas and large-scale employment of trained personnel by the industry have made possible an accelerated advance in all aspects of paper-making. Further advances are possible, and it is to the chemists who are now or will be concerned in them that this book is addressed. It presents the material in fundamental terms, but bridges the gap between strict theory and extreme empiricism.

In such a large and complex task, standard scholarly practices are essential. Detailed documentation, critical review of text by recognized experts, complete author and subject indexes all appear to be carefully and thoroughly done.

The major chapter headings include: cellulose and hemicellulose; lignin; pulpwood; pulping; bleaching; fiber preparation; nature of fiber bonding; sheet formation; filling and loading; internal sizing; surface sizing; wet strength; coloring; microbiology; and water. Volume II deals with the properties of paper, its testing and conversion into special products, use of statistics in the paper industry; pigment coating; printing; laminating and pasting; internal treatment of paper with resinous materials; coating with resinous materials; and resins. It constitutes an outstanding introduction to the utilization of natural and artificial resins in papermaking.

STUDIES ON BRITISH BEECH WOODS. J.M.B. Brown. Forestry Commission Bulletin No. 20. pp. 100. Her Majesty's Stationery Office, London. 1953. 12s.6d.

Based on a comprehensive survey of 200 or more mature beech woods in various parts of Britain, this careful study provides not only interesting historical and ecological background information, but offers much in the way of practical silvicultural guidance in the establishment and management of beech.

The author ascribes the origin of present beech wood distribution in Britain to extensive planting between 1720 and 1850, although in the southern counties of England and perhaps in S.E. Wales, beech is considered a native species. Detailed descriptions are given of the life cycle of beech, relationships between flowering and fruiting and summer temperature, as well as spring frost; the distribution of beech in relation to climate and soil; and the influence of topography, soil characteristics and micro-climate on the form, growth rate and yield of beech.

Using ecological factors as a basis, the author describes practical systems of natural regeneration and compares them with systems used in beech

forests in Denmark and Germany. Reforestation methods are also described with special attention to soil characteristics and local climatic factors.

The study brings out the importance of provenance in forest planting by showing how lack of information as to the origin of the seeds used in the early plantations renders it difficult, if not impossible, to appraise properly the cause of the form of mature beech.

The author is to be commended on the very clear style in which he has presented his material and for his selection of high quality photographic illustrations and diagrams.

REFORESTATION, TEORIA Y PRACTICA. L. Macías Arellano. Dirección General Forestal y de Caza, Mexico. pp. 330. 1952.

Professor Macías Arellano of the National School of Agriculture at Chapingo has made a useful compilation of the experience gained in the reforestation of Mexico. He discusses the objectives of tree planting programs and the factors to consider when developing a reforestation policy; he compares natural and artificial regeneration, planting and direct seeding, pure and mixed stands. He suggests guides to the selection of species such as climatic factors, soil conditions, purposes to be served by the plantations, and the adaptability to later silvicultural treatment, susceptibility to damage by fire, insects, disease, grazing and flooding.

On the practical side, the author explains the best methods of collection, extraction, storage, and testing of seeds, nursery establishment and practices, planting procedures, and how direct seeding is done. This book is undoubtedly intended as a manual for forestry students and for training forest guards.

The illustrations of nursery layout, and of numerous forms of soil erosion control measures, as well as the diagrams of planting operations, should find ready application not only in Mexico but also in the Central and South American countries.

FORSTSAMEN-GEWINNUNG UND FORSTPFLANZEN-ANZUCHT IN DEN U.S.A. UND IN DEUTSCHLAND (Tree Seed Collecting and Forest Plant Production in the U.S. and Germany). Ernst Pein. pp. 218. Illus. M. and H. Schaper, Hannover, Germany. 1953. D.M. 12.60.

This book is a record of a two-month, ECA-sponsored tour of the United States, with special reference to forest nurseries and seed extractories, made by Mr. Ernst Pein, senior partner of the nursery of Pein & Pein of Halstenbek, Holstein, Germany.

The author draws comparisons between United States and German forest planting and nursery problems and points out where each country may learn from the other. Certification of tree seed comes in for rather critical review. He cites Germany's sad experience of 50 to 100 years ago in importing "cheap" Scots pine seed from southern France where the short-boled trees made seed collection easy. When planted in Germany, such seed produced stands of crooked and inferior trees. Shortly after the turn of the century, the Germans began to introduce some measures to control seed origin by certification, culminating in the strict German forest seed law of 1934, which zoned that country into seed collection areas based on climate, and provided for certification of origin even as regards acceptable individual stands.

The author believes germinative energy is a much more important criterion of good seed than total germination capacity. He recommends storage of conifers in airtight glass or metal containers at 1° to 5°C. (approximately 34° to 40° F.).

He thought that the vigor of trees in United States nurseries was somewhat lower than in his own nursery, and attributes this to hesitation to use animal manures because of danger of damping-off, and creation of a weed problem. Many nurserymen would do well to give this comment serious consideration, especially on blocks of spruce and hardwoods which have a generally higher nutrient level demand than pines. Used only on hardwoods or on transplant areas of conifers, or on cover crops, there should be no serious damping-off problem.

The author considers thinning of seed beds undesirable and uneconomic. Probably he has been somewhat misinformed as to how general this practice is in United States nurseries. Actually, in conifer beds, thinning is practically never done on a large scale, the aim being to attain stocks of 50 to 70 plants per square foot (150 to 210 plants per square meter) by thin sowing. This density is low enough to produce good conifer seedling stock for most purposes. Thinning has been done experimentally in accidentally overdense conifer beds merely to prove the point of superiority of trees grown at a lower density.

Progress in weed control methods in both the United States and Germany is discussed. Mineral spirits, which are used extensively in United States nurseries as a selective herbicide, are under test in Germany, but the high cost per gallon of these imported petroleum products and rather low per hour wage for labor will not leave anywhere near the margin of saving in overall weed control that has been found in United States nurseries. However, certain chemicals which could be produced in Germany might give sufficiently economical results to be justified.

The book compares production costs, labor, wages, and insurance, in the United States and in Germany; deals with forest planting and policies in the United States, shelterbelt and erosion control planting, and special aspects of American forestry and forest industries, including fire control, clear cutting in the Pacific northwest, wood utilization and wood waste, logging and transport mechanization, road construction, farm forestry programs and experimental forests.

J. H. Stoeckeler.

LOS CHOPOS Y SUS MADEIRAS (Poplars and their Wood), Vol. I: LOS CHOPOS Y SUS CULTIVOS (Poplar growing). E.G. Vazquez. 1953. pp. 318. Ciudad Universitaria, Madrid. 200 pesetas.

This, the first volume of a monograph on poplars, comprises a detailed study on poplar growing, illustrated by a large number of diagrams, maps and photographs and with a full bibliography. It is divided into two sections. In the first part the author describes the characteristics and geographical distribution of the different varieties and species of the *Populus* genus, and gives some indication of the principal nomenclatures in use. He then discusses the work at present being carried on with regard to poplar culture, devoting considerable attention to the work of the International Poplar Commission and examining the various experimental techniques and methods of selection. This section ends with a detailed description of the principal species and varieties, together with information on site, aspect of the leaves, habit and phenology.

The second part of the volume contains comprehensive documentation on methods of establishing poplar stands and on the care to be given them. There is also an account of poplar growing in the countries principally concerned, particularly in Europe and North America, and of the diseases and insects which attack poplars, both in plantations and nurseries. Finally, as an appendix, the author discusses a project for the creation of a national populetum in the grounds of the University City at Madrid.

At a time when most countries are concerned with increasing their timber production and are planning major afforestation programs, this work will be of value to all those interested in the problems of poplar growing.

Roma, 1953 - S.p.A. Tipografica Castaldi

Legumes in Agriculture

Apart from the publication of the former International Institute of Agriculture *The Use of Leguminous Plants in Tropical Countries as Green Manure, as Cover and as Shade* (Rome, 1936)* no comprehensive review of tropical legumes has yet been attempted. This is done here against a background of information and practices which have been developed in other regions. Now that it is completed, it is possible to see how little is known about legumes in the tropics and sub-tropics. Again, the chief limiting factors appear to be social and economic rather than a lack of leguminous species for all purposes apart from intensive grazing as understood in the white clover zones of the world. Within the existing genera and species, there is almost certainly great scope for the selection and breeding of improved strains adapted to different climates, soils and types of utilization.

The first part of the book deals with the economic botany, ecology and biotic relationships of legumes; their relation to alternate husbandry, association with grasses, use as animal feed. Their particular importance to the tropics and sub-tropics, and the lack of modern data on tropical legumes, made FAO distribute a questionnaire to all tropical countries. The resulting material is to be found throughout the book, but particularly in a chapter which summarises the local practices in the use of legumes, and lists the species concerned. Chapters on poisonous plants and weeds, the significance of symbiotic nitrogen fixation, plant introduction and exploration, adaptation, strain variation and breeding, investigation and testing of improved strains, and the production of seed complete the first part.

Part II lists the principal legumes, with special emphasis on those of the tropics and sub-tropics, and an appendix tabulates the species, indicating plant characteristics, climatic adaptation, soil adaptation, utilization, number of seeds per pound and seeding rates in pounds per acre.

* Available from FAO or through all Sales Agents.

$3.00. 15s.

Soil Surveys for Land Development

Sufficient of the techniques of soil classification and mapping are outlined so that the mode of operation, the type of equipment involved and the cost of the work can be accurately assessed. Maps in colour. Good bibliography. 1953, xii + 110 pp., (E).

$1.00. 5s.

Cadastral Survey and Records in Rights in Land

Sir Bernard Binns, K.B.E., the author of this paper, was for 5 years head of the department of Settlements and Land Records in Burma, and was for two years, as Financial Commissioner, responsible for the whole land records administration of which the Land Records Department was an integral part. vi + 68 pp., (EFS).

$0.50. 2s. 6d.

Communal Land Tenure

Sir Gerald Clauson, K.C.M.G., the author of this paper, was until recently a high official in the British Colonial Office in London. The paper is one of a group of connected studies on land tenure and related subjects to be published as part of the FAO program of agrarian reform. 1953, vi + 58 pp., (EFS).

$0.50. 2s. 6d.

Improving the World's Grasslands

" It is an important contribution to the subject; the general reader will find it of interest, while the specialist will find it invaluable ". Review in *World Crops*. 1951, 147 pp., 107 illustrations, 12 Tables.

$2.00. 10s. 6d.

Weed Control by Growth Regulating Substances

All three editions of this short book have sold rapidly and the Spanish and French editions have been serialized in the agricultural press. 1951, 36 pp., 5 illustrations, 2 tables (EFS). Third English printing.

$0.50. 2s 6d.

Soil Conservation: an International Study

This has been described as the best short handbook on the subject in print. Second printing of the English Edition is now available. 1948, 189 pp., 96 illustrations, map, charts, references (EFS).

$2.00. 10s.

Agricultural Development and Rural Reform in Denmark

FAO is now giving considerable attention to land tenure problems. This monograph covers not only the subject of land tenure, but also several aspects of agricultural development in Denmark closely associated with this subject, so that it can be considered as a significant contribution to the work of FAO in this field. 1953, viii + 320 pp. (E).

$3.00. 15s.

SIX FORESTRY STUDIES

Planning a National Forest Inventory

This short monograph outlines the various types of forest inventories, the administrative problems, the types of forest classification, the preparations of maps and mapping, aerial surveys, ground surveys, the field work, the compilation of data, and the form and presentation of the final report. Available in English, French and Spanish. 1950, viii + 88 pp.,

Price: $1.00. 5s.

Forest Policy, Law, and Administration

In this monograph the need for a forest policy is described, although it is pointed out that the number of possible policies is very high, depending on the regional circumstances. Examples of the variety of developed forest policy are given, for the guidance of officials in countries in the process of developing a forest policy. (EF), 1950, iv + 212 pp.,

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Tropical Woods and Agricultural Residues as Sources of Pulp

Papers presented at the Fifth Meeting of the FAO Technical Committee on Wood Chemistry, Appleton. Wisconsin, U.S.A., 1952, xii + 192 pp.

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Grazing and Forest Economy

Discusses the general relation between grazing and forestry and the regional situations in temperate, tropical and arid zones, 1953, vi + 162 pp.

Price: $2.00. 10s.

Elements of Forest Fire Control

A short handbook on the planning and administration of a national forest fire control policy, 1953, vi + 110 pp.

Price: $1.00. 5s.

Raw Materials for More Paper

The findings of the FAO Pulp and Paper consultation in Rome, December, 1952. Outlines the pulping processes and procedures recommended for testing. This is certainly the most up-to-date handbook on the subject in print. 1953, xiv + 172 pp.

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